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Editors

Law, Development and Innovation

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Foreword

Law, development and innovation. Of these three themes, it is development in which we are ultimately most interested: development is what has lifted a third of the world population out of the direst poverty over the past quarter century and holds the promise of doing the same for others still there. Law and innovation both serve this deeper purpose. How the causality amongst the three runs we do not know precisely. Law may be an enabling factor for innovation, but successful innovation may also call for legal change to facilitate future innovation. Both stimulate development, but development may in turn feedback with a lag to call forth legal adjustments and further innovation.

The questions of how to stimulate development and how law contributes to this process have a long history. Once the economic take-off had occurred in Western Europe, thinkers from Hobbes and Locke, through Rousseau, Montesquieu, Hume, Adam Smith, Adam Ferguson, Bentham, to Marx and Max Weber, to name just these, sought to understand what caused that development and what would need to be done to bring forth further growth.[1]

With the worldwide decolonisation after the Second World War, a new question appeared on the social science research agenda: how to stimulate economic development in the newly free countries, with the pressing request to come up with practical advice for policy makers. The advice must have been all over the map, considering the wide variety of designs that were experimented with in different parts of Africa, Asia and Latin America: from collectivisation and full-scale socialism with five-year plans through nationalisation of key industries to open market economies. Over time we have learnt that most of these experiments have turned out unsuccessful and painful to those subjected to them. The success stories —the Asian tigers, and later China and India—largely relied on open economy models, albeit with local adaptations.

What role law might play in economic development was studied from the 1960s on by the "Law and Development" movement, composed mostly of lawyers and sociologists. One of its main proponents, David Trubek (2012), recently drew up a balance sheet of 50 years of that movement. The results must be judged mixed at best.

[1]The argument that follows has been more fully developed in Mackaay (2009).

Economists tried their hand at the problem following an initial opening by North and Thomas (1973). They insisted on the essential role of secure property rights, shielded from too greedy takings by local power holders, as essential for development. Later research further worked out this and related ideas (Jones 1981; Rosenberg 1986; Landes 1998; Bernstein 2004). Amongst the follow-ups were two books by the Peruvian economist de Soto, pointing out that strong protection of property rights was perhaps not the full story, as it did not lead to the expected growth in Peru and other developing countries (De Soto 1989, 2000).

A more practical turn came when Gwartney and co-workers (1996), starting in 1996 and continuing yearly afterwards, related growth rates to a set of indices reflecting economic freedom and showing that greater freedom was clearly correlated with (and perhaps caused) better economic performance. This was followed by a group of Harvard economists, La Porta, López-de-Silanes, Shleifer and Vishny (1998, 1999), who proposed a broader platform relating a host of indices reflecting the quality of the legal system and other institutions to indicators of economic performance. These papers stirred up an enormous academic debate and led to a host of follow-on studies by a variety of researchers. The World Bank adopted their methodology and applied it at a much larger scale in reports, published from 2004 on, under the title of *Doing Business*, in which the bank formulated specific advice to different countries about legal and policy changes to be implemented with a view to improving economic performance (growth).

The *Doing Business* reports have been controversial in that their early versions attached much importance to differences in legal families, with common law-based systems being thought to perform best, followed by German Civil Code-based systems and at the tail end French Civil Code-based systems. Studies by the Harvard group first highlighted these differences under the title "*legal origins*" (Glaeser and Shleifer 2002). They led to much acrimony in the French legal community (Muir Watt 2009). A critical discussion in 2005 between French legal scholars and World Bank representatives contributed to clearing the air (Canivet et al. 2005). By 2008, the discussions that followed the "legal origins" research as well as the *Doing Business* reports had led to the realisation that the legal origins thesis was not tenable; in later *Doing Business* reports, it was dropped (La Porta et al. 2008; World Bank 2015).

All the data and the methodology used in the preparation of the Doing Business Reports are public and have been widely discussed, and improved as a result. The controversy about legal origins should not obscure the considerable accomplishment of the reports in helping to convince a range of countries to implement legal changes that improve their business climate and accelerate economic growth.[2]

Research has continued on what does and what does not contribute to development. A significant compilation of this research may be found in a book by

[2]The 2013 Report, p. 11, mentions over 2000 such changes worldwide.

Acemoglu and Robinson (2012).[3] They argue that it is not culture, the weather, geography, ignorance of the right policies or colonial history that hold back development; it is man-made political and economic institutions. Nations that adopt "extractive" institutions allowing those in power to enrich themselves at the expense of the rest will advance not at all or very little. By contrast, those adopting "inclusive" policies that support the accumulation of capital, risk-taking and innovation, and hence respect private property will do well. The remarkable fact of development in Western Europe is that nations there stumbled upon such institutions and retained them.

From a legal point of view, Cooter and Schaefer (2012) sum up what these "inclusive" institutions would comprise: whatever is required for innovators and financiers to shake hands and trust each other. That would include well-protected property rights, contract, civil liability rules, business enterprise rules, the stock market, as well as reasonably efficient and non-corrupt courts and other dispute resolution mechanisms. In a recent study, Easterly and Levine (2012) show that European colonists, carrying this institutional as well as technical knowledge with them to countries they colonised, made a long-term positive difference in growth rates for these parts. In their view, this positive contribution largely offset what negative influence their extractive tendencies may have had.

An impressive overview of what we think we know about development may be found in a book by Ferguson (2011). Ferguson argues that six factors—"killer apps" he calls them, to appeal to his then teenage sons—are critical for development. They have been discovered, somewhat fortuitously, in Western Europe, but once known can be "downloaded" and implemented elsewhere, as in fact they are in many parts. These "killer apps" are:

1. The essential role of exchange and commerce.
2. The role of science in driving innovation to improve our lot.
3. Property: representative government and the rule of law.
4. Medicine to improve our life expectancy.
5. The consumer society driving the innovation machine to provide goods consumers are willing to buy.
6. The work ethic (not specific to Protestant countries, as Weber held).

Law, the third factor, is seen here not as given once for all and to be applied by forever interpreting holy scriptures, but as a modifiable institution serviceable to an open economy. The gain is flexibility in the law; the danger is overconfidence in our ability to "social-engineer" law. This overconfidence may lead to redistributive legislation, which amounts to rent-seeking or "extraction," to use Acemoglu and Robinson's term. Even without such perverse intention, the ability to "social-engineer" law is limited, as Hayek (1945, at pp. 521–524; see also Rizzo and Whitman 2009) has pointed out, by the impossibility for a central authority to

[3]A similar argument is made in North et al. (2009). Easterly (2014) argues, similarly, that reigning in power holders and leaving scope for individual entrepreneurial freedom is essential for growth.

know all the circumstances of time and place that will make for the most profitable (or efficient) arrangement as actors in the field, with knowledge of those unique circumstances, would conceive it. This consideration imposes a certain respect for legal arrangements that over time have proven themselves to work well in dealings amongst interested actors. And yet, where such arrangements lead to cartel-like structures or to opportunism, legal change is called for. Legal science should develop the knowledge necessary to distinguish the two, and recognise and correct the latter, without disturbing the former. This is where law and economics has an essential role to play.

In a later book, Ferguson (2012) observes that many nations in the world are now "downloading" the killer apps and implementing them to their advantage. None of them has as yet, in his view, successfully implemented all six of them, as they have been in the "West". By contrast, he observes that in the West, where the killer apps were originally discovered and implemented, confidence in their beneficent effects is on the wane; some question whether the discipline the killer applications impose on civil society is warranted. These voices advocate policies that would weaken incentives to innovate under the guise of protecting the weaker from the uncertainties of the innovation machine. Such moves, if generalised, would lead to the demise of the great innovation machine that was discovered or invented there.

These considerations set the broader background for the reflexions in this book on law, innovation and development. The relations to be highlighted amongst these three elements are part of this broader scene, in which other factors may intervene as well. May we learn more precisely how law can be fashioned to favour innovation and development!

Ejan Mackaay

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Contents

Introduction: Exploring Linkages

Giuseppe Bellantuono and Fabiano Teodoro Lara

Abstract

This introduction presents preliminary reflections on the triangular relationship among law, development and innovation, as well as on how each chapter addresses it. The starting point is that the nexus between law and development can be usefully explored by focussing on innovation dynamics. Being one of the main drivers of development, innovation is a good candidate for an analysis that tries to understand the real impact of the institutional environment. While several different approaches are possible, we suggest that, first, there is no automatic sequence or hierarchical relationship between law, innovation and development; second, that development is directly dependent on the coordination of the two parallel dynamics of technological and legal change. We argue that the lack of such coordination is one of the main reasons why both innovation policies and institutional reforms fail to foster development. After describing the way each chapter deals with the triangular relationship, the Introduction highlights three general suggestions that could be of interest to academic scholars, policymakers and practitioners involved in the law and development field.

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1 Aims of the Book

This book sets out to explore the triangular relationship among law, development and innovation. A huge literature has already explored the bilateral relationships between law and development, development and innovation, and law and innovation. Still, it is not difficult to come upon reviews in each area pointing out the limits of our knowledge about the exact meaning of those bilateral relationships. Trying to simultaneously explore the interplay among the three dimensions adds further complexity and might seem unwise at this stage. If we do not know enough about the bilateral relationships, how can we pretend to say something useful about the more complex, triangular interplay?

In our view, this challenge should be directly addressed on methodological grounds. In this book, we do not propose a general theory which explains how the triangular relationship among law, development and innovation should be analysed. Much less do we propose a theory which identifies the recurring patterns of such interaction. What we propose instead is to focus on those institutional details that could shed light on the triangular relationship. The contributions in this book are meant to provide examples of how that relationship might be affected by existing institutions and by planned reforms. The goal is not to be comprehensive, but to start thinking about useful ways to identify the critical junctures among each dimension. At the same time, the geographical scope of the contributions, covering both developed and developing countries, is meant to suggest that only a deep knowledge of local institutional contexts can help engineer the transformations leading to innovation and, ultimately, development.

In this Introduction we first explain why the analysis of this specific triangular relationship can help move forward the debate about the drivers of development and which methodological hurdles must be tackled for this approach to provide useful data (Sect. 2). We then explore the dynamic possibilities of the triangular interaction and their possible implications (Sect. 3). Finally, we provide an overview of the contributions to this book and discuss how they explore the triangular relationship (Sect. 4).

2 Drivers of Development

The main reason why we suggest the triangular relationship is of crucial importance is that law, or more generally the institutional environment, is in some way linked to both development and innovation. Therefore, we argue that they cannot be understood without taking into account the institutional dimension.

This is, however, just the starting point. We have to come to grips with the disappointing truth that legal reforms have been proposed for decades as the main path to prosperity, but the outcomes have almost always been far below expectations. Harsh criticisms have been levelled at the programs of international organizations that aimed to export the rule of law, as well as at the theoretical frameworks

that do not pay enough attention to crucial factors simply because they are too difficult to measure. In some cases, these dismal outcomes have led to doubt over the relevance of institutions for development. More generally, the idea that it is possible to engineer institutional reforms conducive to development is now viewed with much scepticism.[1]

This is not to say that the analysis of the law-development nexus has lost its appeal. To the contrary, what was once understood as a research field confined to the study of legal reforms in developing countries has now become a more general approach for the analysis of any legal system. The economic crises in the early twenty-first century show that the resilience of Western institutions cannot be taken for granted. Faced with new challenges, both the EU and the US had to adapt their regulatory frameworks and to invent new ways to get rid of recession and economic stagnation.

It is exactly at this point that innovation came to the foreground as the most important driver of development. A large literature had already clarified that innovation and development are tightly intertwined. The almost obvious next step was to suggest that legal rules had to support innovation.[2] To some extent, approaching the problem of development from the point of view of innovation makes it easier to establish links with the institutional dimension. Whereas development is an elusive concept, innovation refers to activities and outputs that are more readily quantifiable and observable. It has been observed above that law and development programs are today viewed with scepticism. The sharpest disagreement is not, however, about the relevance of legal transformations for development, but about the channels that connect changes at the institutional level to changes in the economic, political and social environment. To put it in Tamanaha's (2011) words, the main problem is taking into account the "connectedness of law", that is the connection of law to every aspect of society. Consider, for example, the debate about the global harmonization of intellectual property rights (IPRs). The main criticism brought against such an idea is that harmonization proposals overlook the factors shaping the incentive effects of IPRs. Countries with different levels of economic development, innovation capabilities, integration in international trade, or institutional strength may need completely different rules (Dosi and Stiglitz 2014). But much the same reasoning can be extended to other harmonization debates, for example in the field of competition law (Ezrachi 2012).

To be sure, shifting the focus from law and development to law and innovation does not allow the most vexing methodological problems to be sidestepped. Trying to identify the right channels of legal transformation brings us back to the causal

[1]See, e.g. Tamanaha (2011, p. 9) ("Efforts at law and development have failed for decades"); Trebilcock (2014, p. 139 ff.) (mixed to poor outcomes of institutional reform efforts in developing countries); Davis and Mota Prado (2014) (lack of overarching theoretical framework accounting for the varying relationships between law and development in the Global South); Van Rooij and Nicholson (2013) (discussing reasons for lack of impact of development aid programs).

[2]See Cooter (2014, preface): "Mystery shrouds the causes of innovation because innovation is intensively legal and growth economics is not.". Also see Litan et al. (2011).

relationships between law and development. Empirical research is still struggling to find conclusive answers to the direction of causality and to its nature. As to the former, it cannot be excluded that development is a pre-condition for the creation of good institutions. On the other hand, sometimes good enough (albeit not optimal) institutions may at least marginally contribute to development. Sequence matters, but identifying priorities is still a daunting task. As to the nature of causality, it was mentioned above that legal transformations need to take into account several interconnected factors. This suggests that what is required is an approach that analyses the interaction of multiple factors and weighs their causal contribution. The best candidate for this task seems to be the theories of causality that rely on set-theoretic logic. At the same time, it should be acknowledged that multi-method research approaches combining quantitative and qualitative analyses yield interesting results.[3] Synthetic indicators of institutional quality have often been criticized (Davis et al. 2012). But it would be unreasonable to assume that a single methodological approach can overcome all the hurdles that researchers and policymakers face when they try to engineer the law-development nexus. This means that in this field the best theories of causality are those flexible enough to include data collected with different approaches.

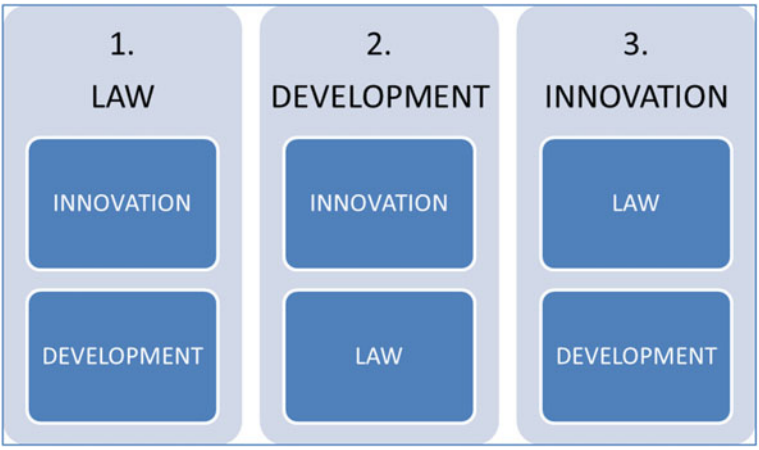
Finding the way to link legal transformations to development is theoretically complex, but at the same time of great practical significance. The hardest task is to identify those factors that, in each institutional environment, have an influence on the application of rules or the performance of an institution. Some factors can be difficult or impossible to change, e.g. deeply ingrained cultural beliefs. But the key issue is to find the right channel(s) which can be exploited to foster the needed transformation. One of the problems (perhaps the most important one) of the programs that have tried to promote the rule of law in developing countries is that they have paid more attention to how to define the final outcome than to the path to be taken to achieve it (Peerenboom 2014, p. 337 f.).

Our focus on the triangular relationship between law, development and innovation is an attempt to identify the right channel. Needless to say, we are just exploring one among many other relationships. But given the widespread consensus about the strong link between technological innovation and development, this is probably the right place to start such an inquiry. Narrowing down the analysis to the interaction between legal change and technological change avoids overbroad statements about the more general relationships between law and other cultural, economic, social and political factors. At the same time, it could be easier to identify those factors that have a more direct bearing on the final outcome.

Of course, innovation, too, raises the problem of the direction and nature of causal relationships. Table 1 shows at least three plausible options. In the first one, legal change drives innovation, which in turn leads to development. This is the usual story told for several decades by supporters of law reform programs modelled after Western institutions. The second option is to assume that development itself,

[3]For different points of view about combining theories of causality in multi-method approaches see Goertz and Mahoney (2012); Blatter and Haverland (2012, p. 205 ff.).

Table 1 Multiple hierarchical relationships



driven by exogenous factors, fosters innovation. This in turn increases the demand for new institutions that can help consolidate and reap the benefits of innovation. In this second scheme, legal change is a by-product of development and technological change. The third option assumes that exogenous factors (e.g. imitation or diffusion) can drive innovation, which in turn fosters a demand for legal change. Development is the outcome of this interaction between innovation and law, but again legal change is demand driven.

There is some truth in each of these three processes. Historical examples confirming each of them are not difficult to find. However, the limit of these descriptions is that they simplify the interaction between law and innovation. The main reason why identifying such interaction is so difficult is that there is no clear sequence or hierarchical relationship between them. Both on the technological and on the legal side, the dynamics of change display features that rule out descriptions of linear and well-ordered sequences. With regard to processes of technological innovation, a large literature shows that they are non-linear, systemic and bound to produce a lot of positive externalities. Of course, these are exactly the features that make it so difficult for both developing and developed countries to devise efficient innovation policies.[4] With regard to processes of legal innovation, it has already been underlined above that interconnectedness among institutions plays a major role with respect to both the pace and the direction of change. It can be added that the weight of the same factor (e.g. the efficiency of the judicial system or the legislative process) can be very high in one institutional context and very low in another. Thus, the number of possible combinations is large. Finally, good institutions share with technological innovation

[4]For a sample of the literature on innovation policies in different areas see Granieri and Renda (2012); Crespi and Dutrénit (2014); Cassiolato et al. (2014); Debackere et al. (2014); Audretsch and Aldridge (2014).

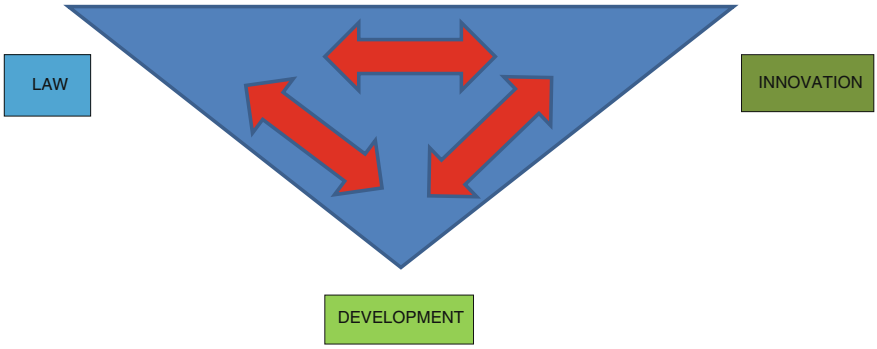


Fig. 1 The triangular relationship

the characteristics of public goods: the incentives to produce them could be quite low because nobody can appropriate all the benefits.

Given that both the technological and the legal side display complex dynamics, we propose to use as the starting point of the analysis the triangular shape in Fig. 1. What it suggests is, first, that there is no automatic sequence or hierarchical relationship between law, innovation and development. But second, the triangle suggests that the two-way interaction between law and innovation is one of the keys to unlock development. To put it differently, development is directly dependent on the coordination of the two parallel dynamics of technological and legal change. The task before us is to understand how that interaction unfolds in the real world and how the two parallel dynamics can be influenced. In the next section, we show how the contributions in this book have tackled this issue from different angles.

3 The Dynamic Nature of the Triangular Relationship

From the vantage point of the triangular relationship between law, innovation and development, some considerations can be proposed about its dynamics. Should we represent it in a timeline, infinite configuration possibilities could be figured out. Nevertheless, not every scenario would be desirable. Only those interactions that increase development should be pursued. The study of this relationship, then, would aim at finding the best available design of the interplay between law, development and innovation in different scenarios and contexts.

It has been pointed out that there is a strong and direct correlation between innovation and sustainable development (Solow 1956; Romer 1990). For that matter, the effects of technological innovation on sustainable economic development are well known by now. There is evidence, however, that sometimes legal institutions do not have a direct effect on innovation or development. In fact, in some circumstances, the influence of legal institutions on innovation and development can be negative.

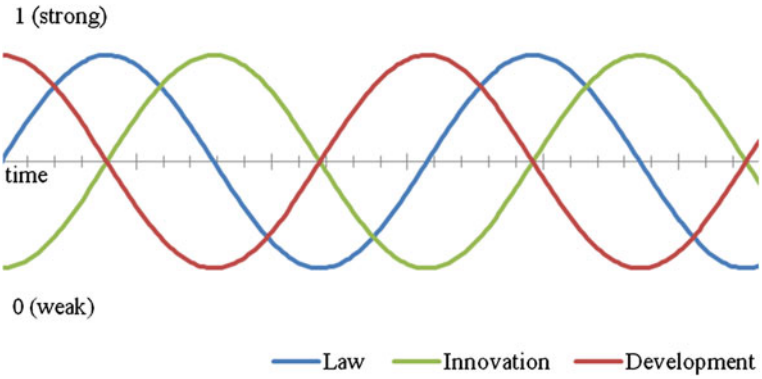


Fig. 2 Dynamic relationships over time: the example of cycling

As a general overview, we could assume, for instance, as in Fig. 2, that an institutional environment with strong legal institutions could drive a strong rate of innovation, in turn positively influencing economic development over time, in cyclical periods. In this scenario, over some time, legal institutions may become weak, pulling down innovation and, consequently, development.

But there are more possible configurations. One may figure out a scenario in which strong legal institutions influence positively the rate of innovation, leading to a strong rate of development. This scenario is represented by Fig. 3.

On the other hand, it is possible to figure out environments in which strong legal institutions, like very strict intellectual property rights, influence negatively the rate of innovation, leading to a very weak rate of development, as represented by Fig. 4.

These different combinations suffice to show that the law-innovation nexus cannot be disentangle from the contexts prevailing in every continent and country. In the next section, we show how the contributions in this book have tackled this issue from different angles.

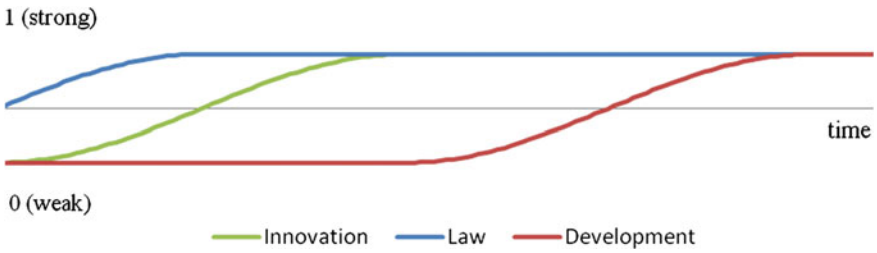


Fig. 3 Law driving up innovation and development

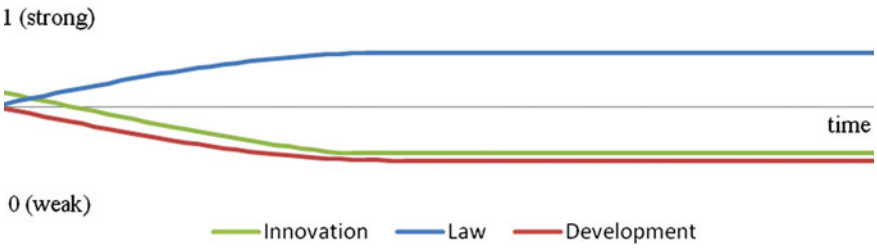


Fig. 4 Law pulling down innovation and development

4 Plan of the Book

In the first part of the book, three contributions deal with some of the most important methodological issues. In Chap. 2, Giovanni Pascuzzi identifies one crucial aspect of the law-innovation nexus, that is the cognitive maneuvers that legal professionals use to 'innovate' or 'create' law. Pascuzzi observes that legal change is a constant feature of the Western Legal Tradition. At the same time, it can unfold through different pathways. Without a sound knowledge of cognitive maneuvers, legal change is bound to be too limited, slow or scattered. Conversely, a clear taxonomy of these maneuvers and of the situations in which they can be helpful is the first step toward a better understanding of the contribution that lawyers can give to the development problem. Also, Pascuzzi observes that law can be considered a technology in itself. This approach makes it clear that institutional choices are directly dependent on (and constrained by) the features of cognitive maneuvers. Hence, the problem-solving strategies available to lawyers shall be taken into account when coordinating the legal and the technological dynamics.

In Chap. 3, Roberto Pardolesi and Danilo Samà undertake an econometric analysis of the impact of competition policy in developed and developing countries. It was mentioned above that quantitative analysis in the law and development field are often criticized because of their methodological limits and their reliance on small sets of institutional data. But Pardolesi and Samà show how quantitative analyses can become one aspect of a broader research strategy. With a sample of 79 countries, their model tests the correlation between the quality of competition law and institutions on one hand and market performance on the other. The main results are, first, that all the institutional indicators have a positive impact on markets; second, that in developing countries what matters most is the independence of the competition authority. These results can be easily matched to the arguments presented in the second section. The relevance of institutional variables confirms that legal change is the product of the interplay of several factors. Moreover, econometric models allow to single out those factors that have a direct impact on the desired outcome (in this case, improving market performance). Of course, the natural follow-up of the econometric analysis is a qualitative analysis that explores the meaning of the independence of competition authorities in specific institutional

environments. But what Pardolesi and Samà show is that a quantitative analysis can guide policymakers (as well as researchers) when selecting their priorities for reform programs.

In Chap. 4, Hugo Acciarri shifts the focus to another factor usually associated with an efficient legal system, that is the availability of enforcement tools that prevent undesired behaviour leading to competition distortion. In order to clarify the impact those tools could have on innovation and development, the author first explains the different meanings of enforcement, then highlights an often overlooked social cost of enforcement, the so called deflection costs. According to Acciarri, enforcement deflection includes costly actions meant to avoid the application of legal sanctions. When agents have this option at their disposal depends on many factors, including the institutional fragility of a specific country. But the most important policy implication is that enforcement deflection is a peculiar type of institutional failure. It asks for remedies that differ from those for other types of institutional failures. More specifically, remedies to enforcement failures that could work for static problems cannot keep under control more dynamic and complex scenarios where the agents are able to use several options. This observation is directly relevant for innovation. Any attempt to prevent use of a technology with a negative social impact shall take into account the possible deflection strategies. The design of remedies should include an assessment of all the relevant categories of social costs. The kind of interdisciplinary approach suggested by Acciarri provides the theoretical framework which might help disentangle the impact of each institutional layer on the enforcement outcome.

The second part of the book collects the chapters that present case studies on specific institutional aspects with a direct bearing on the law-innovation nexus. Not surprisingly, most of them deal with IPRs, but there also is a chapter on entrepreneurship. Drawing on experiences from both developed and developing countries, all the chapters in this part confirm that there is no one-to-one correspondence between technological change and legal change. Several different 'packages' can be used. Moreover, the case studies point to the different meanings of innovation in different geographic areas or policy field.

In Chap. 5, Giorgio Fabio Colombo and Matteo Dragoni analyze the legal processes that led Japan to design an original model of software protection. The authors point out that over time the elements of originality became less prominent and convergence to the US and EU models more evident. Though, the choices made in Japan show how the definition of a new legal problem is directly dependent on the type of knowledge available in a specific institutional context. In the case of Japan, the openness to the use of foreign models went together with the attempt to tailor software protection to some features of the legal system, namely the perception of a close relationship between legal development and technological innovation during the history of the Japanese legal system, the central role played by the Japanese Patent Office and the existence of a specialized court system. What this example from a developed country shows is that one of the key factors influencing the final outcome of legal change is the way foreign and local knowledge interact and are mediated by local institutional actors.

In Chap. 6, Massimiliano Granieri deals with the interaction between legal protection of genetically modified seeds and the peculiar features of biotechnologies. This is a good case study of a more general issue, that is the multilevel interaction that affects the balance among law, innovation and public interests. Because of the need to control the entire value chain, biotech industries holding patents on seeds employ a legal strategy that circumvents the traditional exhaustion principle of intellectual property law. Incentives for private investments are boosted, but the freedom of farmers is heavily constrained. Moreover, negative externalities for less developed countries abound. Granieri explains how different paradigms could be implemented by comparing the US and the EU approaches, as well as the international agreements aimed at fighting biopiracy and protecting biodiversity. However, the analysis seems to confirm the two-way relationship between law and innovation. Such relationship cannot be disentangled from the trajectories of local and global competition.

In Chap. 7, Roberto Caso and Rossana Ducato analyse the development of practices and legal rules related to access to bioinformation. Writing from the perspective of the law and technology approach, the authors observe that sharing of bioinformation is the crucial factor to undertake biomedical and biotechnological research. However, the current legal framework and dissemination practices of the academic community prevent the degree of openness of research data that would foster innovation. Several interrelated factors explain why sharing of data is often less than optimal: lack of public investments, lack of ICT infrastructures, IPRs discouraging collaborative research, contracts strengthening the private control of information through technological measures that ensure the timely sanction of any violation, conflicts with the right to privacy and confidentiality, as well as the lack of reputational or economic incentives in the scientific community. This list of barriers is complemented by the observation that they take on a different meaning in developed and developing countries. Therefore, the attempt to spread sharing practices through open licences or open social practices shall take into account the impact such solutions would have in each context. As suggested in Sect. 2 of this introduction, the global movement supporting universal principles of Open Science and Open Research Data should not be understood as an attempt to impose one-size-fits-all solution, but as a first step toward a better understanding of the interactions among the factors that hamper openness of research data.

In Chap. 8, Valentina Moscon focuses on the role played by academic research in the marketplace for innovation. In developed countries, universities have modified their traditional mission and become active players in patenting activities and technology transfer. However, Moscon points out that this shift has not automatically produced more or better innovation. The entrenchment of the IPRs logic in academic research has produced frictions with the traditional approach to the dissemination of research findings. Moreover, the closer relationship with the industry seems to have had some negative consequences both on the quality of academic research and on the criteria to evaluate it. The Open Access paradigm was born out of a bottom-up process that tried to balance the negative effects of academic research "commodification". While Open Access does not aim at replacing the

traditional scholarly publishing system, it clearly tries to enhance the pluralism of information sources and of public research evaluation. The most important contribution of the chapter is to show, in a comparative perspective, that different national and regional legal systems are experimenting with new rules that attempt to shape new incentives for researchers. The solutions span the entire range from purely voluntary, to semi-mandatory, to completely mandatory approaches. Moscon does not recommend a single approach to OA, but suggests that there is still unexploited room for flexibility at national and international level. In the coming years developed and developing countries will compete among themselves to identify the solutions that balance individual and organizational incentives in the academic world with the public interest to the production and dissemination of high-quality scientific knowledge.

In Chap. 9, Isabelle Deschamps explores the triangular relationship between law, innovation and development by means of a case study on innovative practices of women-led microenterprises in three African states. The main goal of the research is to identify the link between innovative entrepreneurial practices and the reforms of commercial law prompted by the Organization for the Harmonization of Business Law in Africa (OHADA). Drawing on data collected through interviews with entrepreneurs, lawyers and local experts, Deschamps analyzes both the meaning of legal innovation in developing countries and the impact of law on entrepreneurial innovation. From the point of view of legal innovation, she shows that the informal practices of female entrepreneurs are largely driven by a socio-cultural context dominated by a subsistence economy and low levels of schooling. These contextual factors affect the type of innovation (incremental rather than radical), the organizational forms as well as dispute settlement mechanisms. From the point of view of the impact of "official" law on innovation, the author shows that the uniform acts developed by OHDA have had no or a very limited impact on entrepreneurial innovation. The cleavage between informal practices and official law is mainly due to the fact that the reforms of commercial law completely overlooked the socio-cultural factors prevailing in the African countries.

It is our hope that the contributions collected in this book will be of interest to academic scholars, policymakers and practitioners. The main suggestions that we wish to emphasize can be listed as follows:

(a) The triangular relationship among law, development and innovation can only be understood by analyzing the two-way interactions among international, regional, national and local levels of rulemaking and enforcement.
(b) Innovation does not have the same meaning everywhere. Differences in the institutional context contribute to shape its meaning in developed and developing countries.
(c) The primary task for researchers and policymakers interested in fostering development through innovation is to identify the contextual factors shaping innovation processes.

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Part I
Methodological Issues

Cognitive Techniques of Legal Innovation

Giovanni Pascuzzi

Abstract

We can consider the law as a technology: a tool to answer the problems and the needs of human beings. We should not confuse legal certainty with the immutability of law. Changes are a common feature of law in the Western legal tradition. History abounds with examples of legal innovations driven by legislators, courts, lawyers, and scholars. Legal innovation often drives economic development. Behind these innovations, the learned hand of the lawyer is at work. This chapter is not about the legal techniques employed to change the law (for instance, legislative reforms). It looks instead at the cognitive techniques of innovation that lawyers employ. Using selected examples of the most significant legal changes that took place in the last decades in different fields of the law, this chapter tries to single out and describe the cognitive techniques employed when lawyers are called to answer old and new problems.

1 Introduction

This chapter starts from a few theoretical premises, which can be summarised as follows:

1. Law (in the West) is a human invention

It is a historical phenomenon. As such, it has an origin: may be 'invented'.

2. Law (in the West) is in a constant state of change

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As a historical phenomenon, law changes over time because it is both the product and the engine of cultural, economic, social, political, or other types of transformations. Law changes when changes the way of 'thinking the law' and when changes the way of looking at law. Legal change is also due to transformations in rule-making methods, in the content of rules, as well as to the rise of new institutions, new concepts, and new responses to the needs of a society.

According to Harold J. Berman, author of the famous *Law and Revolution*, one of the main features of the Western Legal Tradition is the existence of an intrinsic process of organic change. In particular, Berman (1983, p. 9) writes:

> The concept of a body or a system of law depended for its vitality on the belief in the ongoing character of law, its capacity for growth over generations and centuries—a belief which is uniquely Western. The body of law only survives because it contains a built-in mechanism for organic change.

Harvard Emeritus Professor explains that in the Western Legal Tradition change does not happen by chance but stems from the reinterpretation of the past in order to meet present and future needs. Legal change is also fostered by another feature of the Western Legal Tradition: Pluralism. The latter is the consequence and at the same time the engine of pluralism in political and economic life. As such, it became a source of legal and political development and of economic growth. Internal pluralism periodically led to the violent overthrow of legal systems by revolutions. However, the Western Legal Tradition, which is wider than each of the legal systems it is made of, survived to and was renewed by these revolutions.[1]

By definition, the history of law unfolds through changes, evolutions, transformations, innovations, revolutions and inventions.

3. We can look at legal innovation in many different ways

For instance, sociology explores the relationship between legal change and social change. Lawrence M. Friedman's illuminating pages are devoted to identifying 4 types of change:

(1) Change which originates outside the legal system, i.e. in society, but that only affects the legal system and is confined to it.
(2) Change which originates outside the legal system but that passes through it (with or without some manipulation) and has an impact outside the law, that is in society.
(3) Change that begins inside the legal system and produces its full impact within it.
(4) Change which originates within the legal system and, progressing through it, goes out and produces its impact in society Friedman (1975, p. 269 ff.). Ehrlich, too, has described legal innovations not produced by statutes.[2]

[1]Berman (1983, p. 10). On the concept of change in different legal traditions see Glenn (2014).

[2]In 1913 Ehrlich, (2002 transl., p. 391f.) wrote: "*A glance at legal history will show that even at a time when the state had already gained control over legislation, great changes were always taking place in the law that were not brought about by legislation. Slavery disappeared from Europe during the course of the Middle Ages; from the beginning of the sixteenth century the peasant in England was gradually acquiring an ever increasing measure of liberty, while in Germany his*

Historians, in turn, investigate the pathways of law in the making. Those pathways witness evolutions and changes, even of a radical type. Specific branches of historical studies deal with the general characteristics of legal phenomena at different times (antiquity, the Middle Ages and the modern age) and in different geographic areas. And there are in-depth studies on the origins and development of specific legal institutions, branches of law, legal families, as well as legal principles and ideas.

Legal change may also be observed from the political and institutional point of view, given the close link between the development of law and the evolution of political institutions. When it was created in 1951, the European Coal and Steel Community was a new type of international political institution aimed at organizing and maintaining a common and competitive market for coal and steel.

Another driver of change is the link between law and the economy. Karl Marx's writings are an easy example of the approaches that connect great transformations of law with a revolutionary nature to great transformations of economic structures. At the same time, every small legal change reflects a partial modification of society's economic structure. More generally, it should be noted that key events (e.g. the Industrial Revolution) were possible not only because of technological progress, but also because the institutional system and property rights led to a more effective exploitation of individual motivations, thus channeling human and financial resources towards more socially useful activities and making it possible modern development. Many economic changes are obtained through the creation of legal instruments for the organisation and coordination of human activities. It should not be forgotten that we could not fully understand contract law without considering that it is only the legal scaffolding of an economic transaction. The output of lawyers' rational reflection may be real social engineering projects, or real inventions. For all these reasons, it has now become common to look at legal innovation as a tool that can be deployed to pursue economic objectives. Every economic crisis prompts a legal reaction (e.g. Roosevelt's New Deal).

In comparative legal studies, legal change is one of the main fields of investigation. Techniques supporting the diffusion of legal models have been identified. Imitation of foreign models is one of the most important techniques. There are legislative imitations (e.g. the Napoleonic Code), doctrinal imitations (e.g. the influence of German doctrine in nineteenth century) and judicial imitations. The latter may be: (a) direct imitations of judges by other judges; (b) imitation through intermediaries (like in the case of transnational judicial imitation which takes place through supra-national courts); or (c) judicial imitation through the narrative of the

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(Footnote 2 continued)
freedom was being progressively curtailed; and wherever modern large-*scale industry has been introduced, it has given rise to countless new kinds of contracts, real rights, rights of neighbors, forms of succession, and has influenced even the family law. In the beautifully developing cities of detached houses of our time a servitude requiring the building of detached houses has arisen. Electrical works have given rise to new kinds of real rights, among others the rights of transmitting currents, and new kinds of obligatory contracts, among others the contract to supply electrical current*".

case law made by legal scholars of another country. Alan Watson has devoted much attention to the theme of legal imitation. According to him, in most times and places, borrowing from a different system has been the main driver of development of the law (Watson 1978). It can be added that today this form of legal "creativity" is fostered by increasing recourse to comparison and by the availability of a wider range of information sources.

Legal change plays a crucial role in Law and Technology studies.[3] There is a close relationship between law and technology. More specifically, there is a symbiotic relationship between law and human activities that, by exploiting scientific progress, create new tools, appliances, devices aimed at improving living conditions. Law is called upon to regulate technologies, but at the same time it uses technologies to pursue its own goals. Today attention is focused on digital technologies, but it must be underlined that hardware, software and electronic networks are no more "technology" than paper, pen or language (they are technology for thinking). Legal rules pursue their objectives through the technologies available when they are enacted. Therefore, legal rules are tightly linked to the technologies that made it possible and prompted their enactment. As soon as new technologies become available, it is likely that law will use them to pursue its own objectives (old and new). Hence, the advent of new technologies may lead to the creation of new rules. Looking at the evolution of law in a diachronic perspective it is easy to see that the most important turning points occurred whenever mankind had access to new technologies. The evolution of law also coincides with the evolution of means of communication and of technologies related to them.[4]

Legal innovation may also be explored from another point of view: the cognitive maneuvers employed to imagine new solutions for old and new problems. These pages adopt exactly this point of view.

4. Legal innovation may mean many things

Legal innovation may include different phenomena with different origins. They can be:

- A new approach to legal reasoning. Innovation may consist of new legal concepts and new legal theories. To pick up a small set of legal theories that were developed in the last centuries: natural law, legal positivism, legal realism (with its different versions of realism *stricto* sensu, sociological jurisprudence, institutional approaches). Each theory has proposed different methodologies for the study of law. To mention just a few examples in the last centuries: the school of exegesis, that described the lawyer as the 'mouth of the law'; the historical school (usually identified with Savigny) that looked at law as a system to be built, studied and implemented; the German pandectist school, striving to develop a conceptual pyramid through logical syllogistic methods which should leave no space for creativity; the jurisprudence of interests, that drew on pragmatism and sociology of law and held that rules were the product of various

[3]References to the literature can be found at http://www.lawtech.jus.unitn.it/.

[4]For a more detailed analysis see Pascuzzi (2010).

interests; the new German topical reasoning and its way to organize thinking around problems; Kelsenian neopositivism. There also are the most recent developments: the analysis of language, deontic logic, Perelman's new rhetoric, the economic analysis of law, critical legal studies and so on. We have legal innovation when there is a new approach to legal reasoning.

- Evolution of concepts and institutions. Legal change may manifest itself in the evolution of traditional institutions. A paradigmatic example is the right to property (Lawson 2002).
- Emergence of a new area of law. We also have legal innovation when areas/branches of law are created. This happens because of the evolution/separation/extension of existing branches (e.g. civil liability distinguishing its contents and functions from criminal law) or because new rules are needed to cope with new societal challenges. In the last fifty years the most significant example of legal innovation is represented by European law. The globalisation of trade has led to the regulation of cross-border economic activities. The law of international trade was thus created. It is made by States, inter-governmental organisations (specifically the World Trade Organisation), non-governmental organisations (and in particular the International Chamber of Commerce), as well as transnational corporations (a form of "soft law"). It is a law based on contract (from the individual export transaction to foreign direct investments) and on arbitration as the most important means to solve disputes. Additional examples can be mentioned: environmental law, energy law, social security law, tax law, food law, etc.
- Emergence of new institutions and concepts. Another type of legal innovation is the emergence, within new and old branches, of new institutions and new concepts. The establishment of the European Communities (now European Union) is in itself one of the most significant innovations of the last century. European law changed almost all fields of law. A familiar example is VAT (value added tax) that did not exist before its introduction by European law in 1967. To European law we owe many other new institutions and concepts. Among them the concept of 'universal service', which was used for the first time in Directive 97/33/EC of 30 June 1997 on interconnection in telecommunications. Other examples of European institutions include the EEIG (European Economic Interest Grouping) and the European Company.

It is not uncommon for lawyers to be explicitly recognised as inventors of specific institutions or concepts. Hans Kelsen, for instance, is considered the 'inventor' of constitutional courts Kelsen (1928). He argued that rigid constitutions are not truly guaranteed without special courts charged with the task of monitoring their application. Similarly, Rudolf von Jhering is credited with the invention of 'negative (contractual) interest" (negatives Vertragsinteresse) (Jhering 1860).

5. Techniques of legal innovation

Law changes through the techniques that, in different jurisdictions, are made available by the sources of law. They could be:

- Legislative reform: e.g. the introduction of new laws that attempt to provide different answers to a given problem.

- Evolution of the case law: e.g. judicial *revirements*.
- Innovation in legal practice: e.g. new contracts arising from business practice.

In this chapter we do not deal with technical legal innovation, but with cognitive techniques of legal innovation. The latter help figure out new legal solutions for new and old problems. Any new solution resulting from the application of cognitive techniques must then be introduced into the legal system through the techniques of innovation.

2 Law as Technology

The lawyer is by definition required to solve problems. This is because society looks at law as a tool to be deployed to address its own needs. The legislator is asked to lay down rules aimed at solving a wide range of problems. The judge is asked to solve the problem underlying the dispute between the plaintiff and the defendant. The lawyer is asked to find the most useful answer to the problem her customers face (e.g.: finding means, different from the will, of transferring wealth to the heirs). More specifically:

- Legislation as a solution to all kinds of problems. We are used to thinking that any problem of daily life, from the smallest to the biggest, can be solved by the intervention of the legislator.
- Issues and problems in judicial proceedings. Legal actions are the tool normally supplied by legal systems to apply abstract rules to a specific case. In the perspective adopted in this chapter, legal actions may be regarded as a mechanism to solve problems.
- Private autonomy of the contracting parties in response to problems. Using their private autonomy the contracting parties try to design a legal framework which satisfies their interests and sets up the resulting rights and obligations. The parties enter into contracts to solve problems. The legal system will offer several enforcement mechanisms should one of the parties breach the agreement that the parties themselves considered the more appropriate answer to the problem they were dealing with.

The lawyer can be considered a problem solver. If every technology is defined as an instrument that can improve the conditions of human life (i.e.: means to an end), the emphasis placed on the law as a tool to satisfy human needs and to solve problems lends credit to the idea that law itself may be regarded as a technology.

3 Cognitive Maneuvers for Legal Innovation

Law changes constantly in response to newly emerging problems in society. Lawyers make such a change possible by ‘inventing’ new tools, concepts, institutions.

Ascarelli (1952) wrote: "In the current crisis of values, the world asks lawyers rather new ideas than subtle interpretations". Lawyers are increasingly called upon to provide innovative responses to old and new challenges. When lawyer advises the legislator/regulator about the drafting of new rules; when a judge decides on new demands for legal protection arising from society; when a lawyer suggests new solutions to the judiciary called upon to decide on those new demands; when lawyer develops new contractual tools that satisfy the needs of commercial practice; when lawyer proposes new theories, interpretations, or doctrinal opinions, the lawyer is bound to use the skills of legal innovation. Those skills can be defined: skills of creativity.

Solving problems requires a strategy. Within this strategy we can find those maneuvers that are more useful to promote innovative solutions.

An overall strategy for solving problems can be divided in specific steps.

First of all, the problem should be identified, defined and represented. Mistakes in identifying the contours and constituent elements of the problem lead to solutions that are likely to fail. In this perspective, it is useful to know whether the problem belongs to types already well-known and dealt with in the past (in order to apply the same strategies) or it is a completely new issue that requires further reflection and the design of new solutions. It may be necessary to acquire further knowledge than that already held. It goes without saying that some problems can be easily defined. Conversely, others are difficult to define.

In the light of the foregoing, it is possible to draw up a first inventory of questions which should be asked when called upon to solve a problem. This first group of questions addresses the problem itself. In particular, it might be asked:

1. What exactly is the problem to be solved?
2. Are there different ways to frame the same problem?
3. What are the interests involved?
4. How can the problem be formulated from the point of view of every stakeholder involved?
5. What is the objective sought for?
6. What is the objective that each stakeholder would like to achieve?

The second step is to formulate a strategy to solve the problem. It is useful not to stop at the first strategy that comes to mind, but to consider the pros and cons of each strategy and choose the best. Sometimes avoiding what cognitive psychologists call the "focusing illusion" (Tversky and Kahneman 1974) helps see the problem from different points of view, and thus give rise to innovative and creative solutions. In order to tackle new problems it is possible to try cognitive techniques which help envisage original solutions. Needless to say, 'real' innovation will only be possible if the legal innovation techniques are deployed.

A second group of questions concerns the solutions which are identified through the cognitive techniques. In particular, it might be asked:

1. Is it possible to extend the forms of protection already provided for by the legal system?

   (1a) Is it possible to expand those forms of protection by generalising solutions already introduced in specific contexts?
   (1b) Is it possible to expand the forms of protection by extending solutions already adopted?
   (1c) Is there room for differentiating solutions already adopted?

2. Is it possible to combine different instruments to achieve a specific goal?

   (2a) Is it possible to unify different instruments, institutions, or concepts?
   (2b) Is it possible to link different instruments, institutions, or concepts?
   (2c) Is the hybridization of different instruments, institutions, or concepts possible?
   (2d) Can available elements be arranged in new ways?

3. Is it possible to transform available tools?

   (3a) Can an instrument be used in a way other than the one for which it was conceived?
   (3b) Is it possible to imagine that existing instruments, institutions and concepts can perform functions different from the ones traditionally accepted?
   (3c) Is it possible even to 'distort' the function of instruments, institutions, concepts?
   (3d) Is it possible to change the strategy adopted to pursue an objective?

Further steps of the general strategy to solve problems are: the implementation of the strategy, the monitoring of the chosen strategy and the evaluation of the achievement of the objectives. On this last point it should be borne in mind that the evaluation may not be immediate but require time to be completed. However, it is not uncommon that at this stage new problems arise which require new solutions and new approaches.

The steps briefly described above are but a small example of how to use the skills of creativity or, to put it in different terms, how to select the cognitive maneuvers that are more helpful in finding effective responses to old and new problems.

4 Conclusions

Change is one of the features of law in the Western legal experience. The lawyer is a major innovator. History is replete with examples of innovations resulting from the work of the legislator, the judges, the practitioners and the legal scholars. Behind these innovations is the know-how of the lawyer that uses a number of techniques to provide new responses to old and new challenges.

It would be important to start interdisciplinary research on the skills of creativity in the legal field, i.e. strategies aimed at encouraging the emergence of new ideas. And it would also be important to include teaching of these skills as a permanent feature of legal education: it would be a good opportunity to remind would-be lawyers to never forget considering the consequences of the proposed legal solutions.[5]

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[5]For further information see Pascuzzi (2013).

Is Competition Policy Useful for Emerging Countries? An Empirical Analysis

Roberto Pardolesi and Danilo Samà

Abstract

The ultimate objective of the paper is to empirically investigate the effectiveness of competition policy in emerging countries, focusing on broader indicators of market performance in order to understand whether the presence of an antitrust authority has a significant impact, hence an effective utility, on the level of competition of a developing country. From a policy perspective, the aim of the paper is also to assess whether the enforcement of a competition policy regime in a developing country has the same beneficial effects on the intensity of competition usually claimed to take place in the most developed countries. Relying upon a dataset and the connected econometric model developed by one of the authors, we provisionally conclude that in developing countries the institutional quality of the competition authorities matters more than the mere existence or the degree of competence for the effectiveness of a competition policy regime.

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1 Introduction

The ultimate objective of the present paper is to empirically investigate the effectiveness of competition policy in emerging countries. Although its importance is continuously increasing, the effectiveness of competition policy still seems to lack the attention that it would deserve. At the present state of art, the number of academic contributions that attempts to estimate its impact on relevant economic variables appears very limited, in particular for the less developed countries. However, an empirical literature aimed at measuring in objective terms the effect of competition policy on economic growth is emerging, starting from narrow variables of interest, such as Gross Domestic Product (GDP) and Total Factor Productivity (TFP).

As a result, the current work intends to contribute to this branch of research, focusing on broader indicators of market performance, to understand whether the presence of an antitrust authority has a significant impact, thus an effective utility, on the level of competition of a developing country. In other terms, the research question behind the current work is rather straightforward: is a competition authority active in an emerging country able to implement effectively its primary role? If not, which are the institutional functions and powers that should be strengthened?

From a policy perspective, the aim of the present paper is also to comprehend whether the enforcement of a competition policy regime in a developing country has the same beneficial effects on the intensity of competition usually claimed to take place in the most developed countries. At the same time, it may also be understood whether industrial and institutional differences jeopardize the effectiveness of such a tool of political economy, so much that in emerging countries it would be worthier to assign funds and priority to other tools for economic development.

2 Literature Review

According to the mainstream economic school of thought, competition is the critical process for a market economy to ensure the optimal allocation of resources and the highest level of social welfare. As it is common knowledge, competitive markets enable consumers to purchase better products at lower prices and incentivize firms to improve the quality of the goods and services offered. However, the functioning of competition is not automatic but must be sustained through an intervention by the state, which normally occurs with the adoption of a competition legislation and the creation of a competition authority predisposed to the role of promoter of market democracy. Nevertheless, despite the general consensus, at least from a theoretical standpoint, on the necessity of fostering competition in order to support economic efficiency and fairness on the markets, what appears extremely surprising is the *quasi* absence of academic contributions trying to assess empirically the

effectiveness of competition policy. In the present section, therefore, we provide an exhaustive overview of the results obtained in the empirical literature.

Dutz and Vagliasindi (2000) are the first authors to overcome the traditional approach of the literature, based upon subjective indicators limited to an evaluation of the competition legislations as "in the books". The authors, in fact, exploiting cross-sectional data and looking at the actual practice in 18 transition countries, measure the effectiveness of the different competition policy regimes according to three criteria (i.e. 1. enforcement; 2. competition advocacy; 3. institutional effectiveness). The main result is a positive impact of competition policy on the intensity of competition, the latter as captured by an indicator of economy-wide enterprise mobility. However, the essential drawback of the study remains the low number of countries for which data are available.

Krakowski (2005), after a regression analysis over a sample of 101 countries, reaches two main conclusions: firstly, the experience of the competition authority and the institutional quality of the government explain a substantial part of the perception of the effectiveness of competition policy; secondly, the perceived effectiveness of competition policy and the size of the economy have a significant influence on the perceived intensity of local competition, while the presence of a protectionist trade policy seems to not have any impact.

Kee and Hoekman (2007), analyzing a dataset of 42 countries and 18 industries from 1981 to 1998 and controlling for the number of firms and for imports, study the effect of competition policy on a derived industry mark-up function of price over marginal cost, which is taken as a proxy for the intensity of competition. Although no significant impact is found, the authors observe that market entry is facilitated by the existence of a competition legislation, thus such a legislation has an indirect and positive effect on the level of domestic competition. The main drawback of the contribution is that it simply employs a binary variable indicating whether a competition policy regime is in force.

Waked (2012) focuses on the public enforcement of competition policy in developing countries, building an original dataset of 50 nations and exploiting 20 antitrust variables over a period of 10 years. The input variables present in the dataset include information on budget and staffing levels, while the output variables reflect data such as number of investigations initiated, cases decided, convictions obtained, sanctions imposed, settlements reached and case appeled for abuse of dominance, cartel and merger cases. The remarkable merit of the work is the successful attempt to collect statistical data on the actual enforcement of competition policy in emerging countries, despite the common belief according to which it would be an impossible task. The only drawback is the adoption of a resource-based methodology for the input variables, as well as the employment of descriptive statistics for the output variables which count the number of interventions by antitrust authorities. In fact, endowments and resources of competition authorities are a measure of potential enforcement intensity, while the number of interventions is not a measure able to judge if the enforcement is efficient or not. Both elements could be used by developing countries merely to assure and signal compliance to

international standards. Nevertheless, the main conclusion of the paper still remains, that is the fact that emerging countries which have adopted a competition policy regime show an increasing degree of enforcement intensity.

Petersen (2013), using a dataset of 154 countries from 1960 to 2005, finds that competition policy has a strong effect on the level of GDP after ten years, whilst there is no relevant impact on the quality of democracy. Thus, market fragmentation seems neither to favor the transition to a democratic regime nor to strengthen the stability of an established democracy. The most plausible reason for this might be that competition policy is not designed to prevent economic concentration at conglomerate and national level (which, in turn, could promote democracy), but only in particular and specific sectors. Also here, the main weakness of the study is that the effect of competition policy is merely controlled for by a dummy variable.

Finally, Buccirossi et al. (2013) estimate the impact of competition policy on productivity growth, analyzing a sample of 22 industries in 12 OECD countries from 1995 to 2005. In order to measure the effectiveness of the different competition policy regimes, the authors construct, principally on the base of a tailored questionnaire, a set of Competition Policy Indicators (CPIs), assessing, for each country and each year, the antitrust infringements (the Antitrust CPI), the merger control process (the Mergers CPI), the institutional features (the Institutional CPI), the enforcement features (the Enforcement CPI) and all the information on the competition policy regime in a jurisdiction (the Aggregate CPI). The main conclusion consists in a positive and significant relationship between competition policy and TFP. Although the only drawback of the contribution is the small size of the sample, exclusively restricted to a part of the OECD countries, the methodology adopted as well as the indicators built are certainly very useful for further in-depth analyses and refinements.

3 Dataset Description

In Samà (2014), the empirical assessment has been divided into two main parts. The first part analyzes developed and developing countries together, to obtain a general overview of the phenomenon studied. The second part examines exclusively developing countries, to understand whether the adoption of a competition policy regime should be among the priorities in the political agenda of an emerging country. The main reason for this distinction is to disentangle the effect of competition policy in such different contexts. This comparison may provide a better picture of the impact, also because in developing countries competition policy has been introduced only recently in comparison to developed countries.

Accordingly, the first group includes the majority of OECD countries (i.e. 28 nations), whilst the second group includes all the developing countries for which data are available (i.e. 51 nations). Hence, the total number of countries present in the sample is 79 (by 2008, 111 countries had enacted a competition legislation

(Papadopoulos 2010). The result is a cross-sectional dataset, created ad hoc merging several existing datasets, with 2008 as common reference year. For definitional sake, the term competition policy should be intended as any national law which promotes market fairness by regulating anti-competitive conducts undertaken by firms. With competition authority it is meant any institution which is set up for enforcing competition policy and is not sector specific.

The independent variables of the dataset, i.e. the set of input variables to be tested in order to verify if they are the cause of the phenomenon object of study, results from a questionnaire submitted to competition agencies worldwide in 2007 and from which four indicators relative to the institutional quality of competition policy of each country are derived and used in Voigt (2009). In particular, the survey, whose response rate is around 63 %, was sent to 140 agencies belonging to the International Competition Network or participating to the Intergovernmental Group of Experts on Competition Law and Policy. The questionnaire was constructed so that respondents would not have to express personal perceptions but to provide factual information about the national competition policies.

The dependent variables of the dataset, i.e. the set of output variables to be tested in order to verify if they are instead the effect of the phenomenon object of study, results from the Global Competitiveness Report, annually published by the World Economic Forum (2013). It assesses the class of factors, institutions and policies that influence the current and medium-term levels of economic prosperity of 144 different countries. Since 2004, the report proposes a wide range of data, based on 110 variables across 12 pillars, about areas such as competition, education, finance, health, infrastructure, institutions, labour and technology. Data are collected through over 15,000 surveys with leading business executives who are asked to rank the determinants of competitiveness of their respective countries. This corresponds to an average of 100 respondents per country. In particular, the study offers the Global Competitiveness Indexes (GCI) (World Economic Forum 2013) measuring the microeconomic and macroeconomic foundations of national competitiveness worldwide.

In this regard, it is necessary to notice that, at least at the present state of art, there is a practical impossibility to find objective data about the intensity of market power, a solution that would represent of course a first best scenario. The basic reason for this limitation is that data such as level of concentration, mark-up on prices or number of market entries are available only for specific sectors of certain nations and in any case would remain rather insignificant if computed with respect to an entire economy. Thus, it is necessary to proceed to a second best scenario, that is to resort to indicators of market performance obtained from evaluations expressed by business respondents about a country competition intensity. Despite the unavoidable drawbacks that this solution entails, being data extracted from surveys not perfectly objective, the present paper still intends to investigate at a macroeconomic level whether the presence of a competition authority affects the degree of competition of a developing country. Future research, having at its disposal more rigorous and significant data, could certainly provide further answers to the research question at issue.

4 Econometric Model

The econometric model developed in Samà (2014) aims at estimating the effect on market performance of competition policy in developing countries, the latter evaluated according to four institutional indicators. These indicators, built in Voigt (2009) and originally used to assess empirically the impact of competition policy on TFP, measure: 1. the substantive content of the competition law; 2. the degree to which the competition law incorporates an economic approach; 3. the formal independence of the competition authority; 4. the factual independence of the competition authority. In particular, as mentioned in the previous section, this set of indicators has been constructed as a result of a questionnaire formed of 30 questions and submitted to 140 competition authorities worldwide.

As a result, the four institutional indicators, which evaluate the degree of competition orientation and authority independence, are investigated with respect to the impact on five indicators of market performance. These five indicators of market performance, built by the World Economic Forum (2013), measure: 1. the intensity of local competition; 2. the extent of market dominance; 3. the effectiveness of anti-monopoly policy; 4. the intensity of national competition; 5. the goods market efficiency. In particular, as mentioned in the previous section, this set of indicators has been extracted from the 6th pillar (i.e. Goods Market Efficiency) of the Global Competitiveness Indexes (GCI).

Accordingly, in the econometric model, the four institutional indicators are employed as explanatory and independent variables, whilst the five performance indicators are used as explained and dependent variables. Nevertheless, all the variables that may affect the relationship between the variables of primary interest must be monitored, even though they may not be the focus of the study. Control variables, in fact, allow the econometrician to strictly measure the effect under examination, avoiding the so-called omitted-variables bias and improving the goodness of fit of the econometric model. Therefore, along the lines of Voigt (2009), four standard economic control variables are employed, such as government consumption, trade openness, rate of inflation (Aten et al. 2002) and patents protection (U.S. Department of Commerce 2005), under the reasonable assumption that they are all factors which influence, positively or negatively, the establishment of a competitive environment. Moreover, two other control variables must be considered, that are an EU dummy, as the dataset includes countries members of the European Union, which are thus subject not only to the respective national competition authorities but also to the vigilance exercised by the Directorate-General for Competition (DG COMP) of the European Commission, and an OECD dummy, given the higher level of social welfare of OECD countries. The five control variables are the same regardless of the dependent variable used, since the performance indicators are likely to be affected by similar dynamics.

The high intensity of competition typical of developed countries, as well as the high extent of market dominance typical of developing countries, might facilitate the establishment and the effectiveness of a competition authority. This mechanism

raises the question of endogeneity, as reverse causality (i.e. the effect precedes the cause, contrary to normal causation) might emerge between the dependent and independent variables of the econometric model. In order to deal with this issue, a further category of variables is employed, that are the instrumental variables. In particular, in the econometric model, the same three instrumental variables are used for each of the four independent variables. Actually, endogeneity problems may still remain due to omitted variables. However, to address the omitted variable bias, several controls are employed as mentioned above.

The first instrument is a dummy variable for former British colonies (Aten et al. 2002). As proved by historical evidence, a common law legal system, typical of countries that in the past belonged to the British Empire, is more likely to adopt a competition policy regime compare to a civil law legal system, so that the legal origin influences the enforcement of an institution such as a competition authority. The second instrument is the age of democratic regime (Beck et al. 2001), under the assumption that a country with a longer democratic tradition is in more suitable conditions to establish and enforce a competition policy regime. The third instrument is the ethnic and linguistic fractionalization (Alesina et al. 2003), element that traduces the difficulty of implementing valuable institutions.

We can now proceed with the discussion of the estimation phase. At a first step, the Ordinary Least Squares (OLS) method, without and with control variables, is employed as estimation technique in order to carry out a preliminary assessment. At a second step, after evaluating the validity of the instruments chosen through the Sargan test, the Two-Stage Least Square (2SLS) and the Generalized Method of Moments (GMM) are employed as estimation techniques, being able to improve the prediction quality of the econometric model exploiting the information provided by the instruments.

5 Estimation Results

In order to obtain a general overview of the phenomenon object of the study, firstly developed and developing countries are analyzed together. Table 1 contains the OLS regression estimates without and with the standard economic control variables. It can observed that all the institutional indicators present the expected sign, that is competition policy has a positive impact on all the performance indicators, although rather marginal but more significant when control variables are considered. This means that competition authorities, even if to a limited extent, are usually able to implement effectively the role of promoters of fair competition. From Table 2, which contains instead the OLS regression estimates over developing countries only, we can observe that only the formal independence of the competition authorities impacts positively on the performance indicators, while the degree to which the competition law incorporates an economic approach and the formal independence of the competition authority present a significant impact in a limited

Table 1 OLS estimation of performance indicators on competition policy indicators without/with control variables (developed and developing countries)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	1.331***	0.431	1.594***	0.245	1.785***	0.457	0.858**	0.066	1.123***	0.234
	(0.316)	(0.330)	(0.454)	(0.404)	(0.448)	(0.427)	(0.299)	(0.263)	(0.309)	(0.273)
R^2	0.189	0.458	0.140	0.622	0.173	0.585	0.098	0.589	0.148	0.608
SER	0.675	0.550	0.968	0.671	0.955	0.711	0.638	0.438	0.659	0.455
N	78	69	78	69	78	69	78	69	78	69
$COMP_{economics}$	1.068***	0.604*	1.483***	0.825*	1.725***	1.176***	0.820***	0.536*	0.988***	0.657**
	(0.235)	(0.287)	(0.321)	(0.331)	(0.299)	(0.322)	(0.217)	(0.210)	(0.225)	(0.218)
R^2	0.228	0.492	0.233	0.671	0.322	0.685	0.170	0.666	0.216	0.686
SER	0.677	0.549	0.925	0.634	0.862	0.617	0.625	0.403	0.647	0.418
N	72	63	72	63	72	63	72	63	72	63
$COMP_{dejure}$	1.452***	1.017**	1.907***	1.264**	2.334***	1.806***	1.092***	0.856***	1.324***	1.009***
	(0.309)	(0.314)	(0.434)	(0.375)	(0.400)	(0.360)	(0.289)	(0.240)	(0.298)	(0.244)
R^2	0.234	0.526	0.212	0.679	0.321	0.702	0.166	0.667	0.215	0.697
SER	0.665	0.521	0.932	0.622	0.860	0.597	0.620	0.626	0.640	0.405
N	74	65	74	65	74	65	74	65	74	65
$COMP_{defacto}$	1.163***	0.848***	1.568***	0.960***	1.818***	1.376***	0.870***	0.614**	1.060***	0.764***
	(0.206)	(0.226)	(0.288)	(0.272)	(0.259)	(0.267)	(0.2)	(0.182)	(0.203)	(0.181)
R^2	0.329	0.574	0.313	0.698	0.431	0.706	0.225	0.665	0.295	0.708
SER	0.629	0.512	0.880	0.615	0.791	0.604	0.612	0.413	0.620	0.411
N	67	59	67	59	67	59	67	59	67	59

*p < 0.05, **p < 0.01, ***p < 0.001 (standard errors in parentheses)
Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU

Table 2 OLS estimation of performance indicators on competition policy indicators without/with control variables (developed and developing countries

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
$COMP_{law}$	0.538	0.389	0.006	0.074	0.273	0.341	−0.168	−0.236	0.174	0.120
	(0.390)	(0.416)	(0.464)	(0.489)	(0.453)	(0.516)	(0.341)	(0.314)	(0.352)	(0.334)
R^2	0.038	0.299	0.000	0.370	0.008	0.295	0.005	0.495	0.005	0.469
SER	0.641	0.573	0.762	0.673	0.745	0.711	0.561	0.433	0.579	0.461
N	50	42	50	42	50	42	50	42	50	42
$COMP_{economics}$	0.321	0.382	0.320	0.758	0.677*	1.108**	0.094	0.405	0.279	0.583*
	(0.319)	(0.392)	(0.370)	(0.422)	(0.329)	(0.384)	(0.274)	(0.259)	(0.281)	(0.274)
R^2	0.024	0.329	0.018	0.477	0.092	0.510	0.003	0.619	0.023	0.610
SER	0.673	0.599	0.780	0.645	0.693	0.587	0.578	0.396	0.593	0.419
N	44	36	44	36	44	36	44	36	44	36
$COMP_{dejure}$	0.708	0.818	0.774	1.116	1.236**	1.664	0.347	0.649	0.580	0.839**
	(0.357)	(0.384)	(0.418)	(0.429)	(0.376)	(0.396)	(0.315)	(0.278)	(0.319)	(0.285)
R^2	0.082	0.378	0.072	0.488	0.197	0.547	0.027	0.583	0.07	0.597
SER	0.645	0.564	0.755	0.630	0.678	0.582	0.569	0.409	0.576	0.418
N	46	38	46	38	46	38	46	38	46	38
$COMP_{defacto}$	0.601*	0.641*	0.648	0.843*	1.076***	1.362***	0.277	0.483*	0.474	0.664**
	(0.274)	(0.298)	(0.337)	(0.355)	(0.294)	(0.318)	(0.257)	(0.228)	(0.257)	(0.228)
R^2	0.110	0.427	0.087	0.497	0.256	0.584	0.029	0.598	0.080	0.629
SER	0.632	0.556	0.777	0.660	0.678	0.592	0.591	0.425	0.593	0.424
N	41	34	41	34	41	34	41	34	41	34

$p < 0.05$, $**p < 0.01$, $***p < 0.001$ (standard errors in parentheses)
Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU

Table 3 2SLS and GMM estimation of performance indicators on competition policy indicators with control and instrumental variables (developed and developing countries)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	PERF antitrust	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	1.319	1.411	1.770	2.033	1.448	1.285	0.293	−0.065	0.980	0.806
	(0.949)	(0.816)	(1.218)	(1.065)	(1.211)	(0.796)	(0.720)	(0.495)	(0.787)	(0.523)
R^2	0.394	0.377	0.534	0.499	0.549	0.545	0.583	0.580	0.561	0.574
SER	0.546	0.554	0.701	0.727	0.697	0.700	0.414	0.416	0.453	0.446
N	69	69	69	69	69	69	69	69	69	69
$COMP_{economics}$	2.265	2.434**	2.857	2.732*	3.734*	4.053*	1.486	1.778*	2.105	2.398**
	(1.407)	(0.887)	(1.660)	(1.107)	(1.824)	(1.730)	(0.952)	(0.843)	(1.132)	(0.875)
R^2	0.183	0.116	0.4460	0.472	0.3241	0.227	0.543	0.451	0.436	0.323
SER	0.651	0.677	0.76881	0.751	0.84442	0.903	0.441	0.483	0.524	0.574
N	63	63	63	63	63	63	63	63	63	63
$COMP_{dejure}$	2.335*	2.445	2.678*	2.636	4.689**	4.71	2.289*	2.404	2.586**	2.511
	(1.111)	(0.825)	(1.295)	(0.975)	(1.622)	(1.480)	(0.945)	(0.878)	(0.994)	(0.765)
R^2	0.380	0.354	0.599	0.603	0.367	0.361	0.458	0.495	0.475	0.495
SER	0.558	0.570	0.651	0.648	0.815	0.818	0.475	0.490	0.500	0.490
N	65	65	65	65	65	65	65	65	65	65
$COM\ P_{defacto}$	1.880*	1.999***	1.845*	1.823**	3.069**	3.292**	1.485*	1.747*	1.813*	1.994**
	(0.825)	(0.567)	(0.919)	(0.660)	(1.098)	(1.206)	(0.675)	(0.751)	(0.718)	(0.702)
R^2	0.400	0.357	0.635	0.636	0.473	0.406	0.515	0.410	0.517	0.444
SER	0.565	0.585	0.629	0.628	0.751	0.798	0.462	0.510	0.492	0.528
N	59	59	59	59	59	59	59	59	59	59

*p < 0.05, **p < 0.01, ***p < 0.001 (standard errors in parentheses)
Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU
Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization

Table 4 2SLS and GMM estimation of performance indicators on competition policy indicators with control and instrumental variables (developed and developing countries)

Variables	PERF local	PERF local	PERF dominance	PERF dominance	*PERF antitrust*	PERF antitrust	PERF competition	PERF competition	PERF efficiency	PERF efficiency
Technique	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM	2SLS	GMM
$COMP_{law}$	0.740	0.729	0.560	−0.114	−0.396	−0.482	−0.770	−0.861	0.025	−0.169
	(1.028)	(0.995)	(1.211)	(1.195)	(1.297)	(0.890)	(0.799)	(0.551)	(0.818)	(0.645)
R^2	0.284	0.283	0.352	0.363	0.254	0.209	0.4535	0.437	0.468	0.456
SER	0.529	0.529	0.623	0.618	0.667	0.687	0.41112	0.417	0.421	0.426
N	42	42	42	42	42	42	42	42	42	42
$COMP_{economics}$	1.972	2.004	2.624	2.463*	2.383	2.407*	−0.088	−0.138	0.872	0.883
	(1.964)	(1.034)	(2.184)	(1.167)	(1.806)	(1.130)	(1.099)	(0.676)	(1.117)	(0.668)
R^2	0.125	0.182	0.125	0.182	0.324	0.309	0.571	0.550	0.595	0.591
SER	0.749	0.724	0.749	0.724	0.619	0.626	0.377	0.386	0.383	0.385
N	36	36	36	36	36	36	36	36	36	36
$COMP_{dejure}$	1.438	1.746***	2.149*	2.127**	3.192**	3.097***	1.438	1.746***	2.149*	2.127**
	(0.899)	(0.466)	(1.051)	(0.675)	(1.084)	(0.892)	(0.899)	(0.466)	(1.051)	(0.675)
R^2	0.325	0.257	0.392	0.394	0.330	0.557	0.325	0.257	0.392	0.394
SER	0.530	0.557	0.620	0.619	0.640	0.380	0.530	0.557	0.620	0.619
N	38	38	38	38	38	38	38	38	38	38
$COMP_{defacto}$	1.282*	1.279***	1.458*	1.499***	2.087**	1.880*	0.826	0.620	1.040*	0.944*
	(0.618)	(0.274)	(0.715)	(0.437)	(0.665)	(0.877)	(0.455)	(0.491)	(0.457)	(0.409)
R^2	0.329	0.330	0.440	0.431	0.503	0.535	0.565	0.581	0.591	0.604
SER	0.536	0.536	0.620	0.625	0.576	0.558	0.394	0.387	0.396	0.390
N	34	34	34	34	34	34	34	34	34	34

*p < 0.05, **p < 0.01, ***p < 0.001 (standard errors in parentheses)
Control Variables: Government Consumption, Openness, Inflation, Patents, OECD, EU
Instrumental Variables: British Colony, Age of Democratic Regime, Ethnic-Linguistic Fractionalization

number of cases. On the contrary, the fact that an emerging country has adopted a specific legislation safeguarding competition seems to not have any effect on the markets.

For a more sophisticated inference analysis based on estimation methods such as 2SLS and GMM it is necessary first of all to check the relevance of the instruments chosen. In an overidentified model, where the number of instrumental variables exceeds the number of explanatory variables, the Sargan's test can be used to verify the validity of the instruments selected. The validity of the instruments for all four institutional indicators of both developed and developing countries has been positively tested. Consequently, even though this test has low power and provides no guarantee that the instruments used are valid, it brings further evidence to support the direction of the model's results.

Proceeding with the more advanced estimation techniques, from Table 3, which contains the 2SLS and GMM regression estimates for the entire sample, we can observe results that confirm those obtained under OLS. Although the substantive content of the competition law seems to lose statistical significance, what emerges, and this is more important for our purposes is that the estimates for the other three institutional indicators are stronger than those obtained through the OLS estimation, reaching in several cases the standard significance level of 5 %. Instead, from Table 4, which presents the 2SLS and GMM regression estimates only for the subsample of developing countries, we can observe results that confirm as well what is stated in Table 2, that is the fact that in emerging countries the factual independence of competition authorities seems to matter most. Furthermore, the impact of the formal independence of competition authorities appears strengthened in comparison to that one obtained through the OLS estimation, whilst the presence of economists still maintains a positive effect in some cases.

6 Conclusions

In the present paper, the aim has been to investigate the effectiveness of competition policy in developing countries from an empirical standpoint. It has shown that four competition indicators, originally built to explain differences in productivity, once controlled with the proper economic and institutional variables, seem to have an effect on five market indicators. Although not particularly strong, the presence of a competition authority increases the degree of competition of a country.

In particular, two main results are worth recapping. Firstly, as a general trend, apart from the mere adoption of a competition legislation by the national parliaments, all the institutional indicators exercise a positive impact on the markets, therefore competition authorities seem to be effective in enhancing the level of competitiveness of the respective countries. Secondly, as for the poorest countries, with respect to which we are interested in verifying whether the enforcement of a competition policy regime should be favored, what seems to be the most important factor for its effectiveness is the factual independence of the authorities predisposed.

The essential reason for this should be that the quality of the institutions of developing countries is certainly lower than the one of the industrialized nations, being affected more frequently for example by cases of corruption or government interference. In any case, one conclusion seems certain, that is competition policy is not harmful to development.

However, emerging countries, historically characterized by the nationalization of basic industries, are still adopting or constructing primordial competition policy frameworks, whose results could be seen only in delay, so in the near future. Actually, to be more precise, 81 of the 111 of the existing competition authorities worldwide have been created only in the last twenty years. Moreover, private enforcement, although still in an embryonic phase even in the developed countries, could undoubtedly make the market surveillance, thus the market efficiency, stronger.

As a result, in developed countries competition policy has actually beneficial effects on the intensity of competition, result so far unclear and often claimed only on the paper or taken for granted, while in developing countries is not the mere existence or the degree of competence, but the institutional quality of the competition authorities matters most for the effectiveness of a competition policy regime. In both cases, therefore, the creation of a competition authority is definitely worth, even though its functions and powers should be strengthened in order to register a more significant impact on the markets in comparison to the current results. Future research, exploiting more precise data that we hope will be available soon (e.g. panel data concerning specific sectors and not as here cross-sectional data related to an entire economy), could certainly offer further support to the conclusions here reached.

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Enforcement Deflection and Innovation

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Abstract

Enforcement and *innovation* are both usually associated with development and deemed desirable. Relationship between them is, however, less than smooth and peaceful. Some enforcement issues, although general, show particularly critical when facing innovation. Law and regulation usually take into account only a limited set of features of human activities and their products to trigger enforcement mechanisms. Herein, they are called *anchor properties*. If the option is cheap, there are strong incentivesfor interested parties to manipulate them. Result of these actions, being privately beneficial, is socially detrimental. The term *deflection* is used in this work to name that effect. Actions intended to deflect enforcement can be illegal, as the ones included within the *doctrine of evasion* in Anglo-Saxon systems (in France, *fraude à la loi*, in Spain, *fraude de ley*, in Germany, *Rechtswidrige Umgehung eines Gesetzes*) or even legal. Rationally turning into judgment proof is an emblematic instance of this behavior and a good benchmark to model their effects. Innovation can, and usually does, alter present relations between levels of activity/care and levels of harm, as well as correspondence between those levels and anchor properties taken as representative of them. That dynamics gives place to enforcement problems and, in special, peculiar instances of deflection. Deflection increases social costs by several ways. On the one hand, by weaken deterrence. On the other, and related to innovation, deflecting enforcement of schemes designed to promote innovation distorts competition between present and new technologies. Both, increase social cost. Moreover, some usual strategies intuitively intended to cut down chances of deflection (second-order enforcement strategies and

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rising the amount of sanctions) can be less efficient than rival frameworks, because they disregard some non-obvious costs.

1 Introduction

Law enforcement and *innovation* are both usually and intuitively associated with *social and economic development*. A correct (whatever the adjective means) enforcement is normally deemed a precondition towards development. Innovation, a source of social welfare. Development, in turn, a sort of social goal morally and politically desirable. Hence, building an environment favorable to innovation within which rights are properly enforced appears to be a desideratum of public policy.

There are however, some subtleties involved in that statement. Some vagueness in the usage of its key-terms makes some instances of consensus only apparent. It is not clear what an *environment that fosters innovation* means. For some economists, legal and social scholars that environment demands direct subsidies or even state-run initiatives. For others, those options are unacceptable but they often advocate for a legal framework including some kind of implicit subsidization to innovation. At least, some peculiar sort of immunity to legal liability. A selective reduction in the stringency of enforcement would accomplish that effect. Caps to liability for incipient industries at earlier stages of their development, e.g., airlines, is a good instance of that relative lessening. The so-called risks of development as a defense against liability for unforeseeable harms can also be interpreted that way, in economic terms.[1] Producers of ordinary goods are, in broad terms, entitled to get all the benefits and correlatively liable for all the harm caused by them. Differentially, when risks of development defense is admitted, producers are entitled to appropriate all the gains of their products, even those derived from unforeseen usages, but they are exempt from liability for their unforeseeable risks.

Within that frame, the aim of this work is not to discuss the best technical ways to promote innovation nor to solve the dispute on their ideological limits, but to shed some light on certain effect of broad range, but particularly influential on institutional frameworks intended to deal with innovation. The significance of those suggestions is instrumentally common to every public policy on the matter.

That goal demands some prior clarifying remarks on certain conceptual issues.

2 Law, Development and Enforcement

The study of the linkage between *law* and *development* involves a number of visibly differentiable issues (Buscaglia 1994). Divergent conceptions on the meaning and usage of the words pervade the debates. Just to enter the field, a couple of semantic

[1] See Sect. 7.

issues hamper the track. On the one hand, the traditional dispute on *what the law is;* on the other, the controversy on the meaning of the expression *economic development*. Setting aside the former, state-of-the-art research firmly rejects the equivalence of *development* and *economic growth*. However, in an ample number of cases, increasing the size of an economy is generally deemed a determinant or at least a crucial factor, in order to reach a state of affairs deserving to be named *developed*.

Development Although the quest for the most suitable content for the expression *economic development* is still unfinished, authorized voices seem to have succeeded in capturing some core-commonsense notions. Among those, Sen's appeal to "entitlements of people and capabilities these entitlements generate" (Sen 1983) has commanded a broad assent and set up the underpinnings for further and more specific developments. Either in theoretical field (Chekera and Nmehielle 2013; Nmehielle and Madhava Menon 2014), or in international legal documents (U.N 1986) it is possible to see the impact of Sen's claim. In turn, particularized approaches give place to a sequel of considerable dispersion. Yet, all the lines of thought share an underlying positive view—*development*, whatever its detailed content, its instruments and its actual instances, is regarded as a desirable aim, a good goal to reach.

Law and law enforcement Regarding the role of the law as a significant factor to foster development, two waves of thinking have been identified (Ginsburg 2000). The first, inspired by one strand of Weber theoretical framework assumed that a rational legal system played a crucial role in the economic development of the Protestant West, by allowing individuals to order their transactions with some predictability (Weber 1979). The second wave, "…inspired by North's explanation of the rise of capitalism entails a subtle shift from the predictability of substantive norms to the predictability of enforcement…North places the individual entrepreneur at the center of his theory…These wealth-creating private actors are threatened with appropriation from two fronts: from the sovereign on one hand, and from other entrepreneurs on the other (see Olson 1993)…. Enforceable contract law prevents private firms from appropriating value…. North's ideas have had great influence in development agencies in the "second wave" of law and development in the 1990s…" (Ginsburg 2000).

Any of both visions might be challenged by an array of questions. Among them, the former has been criticized for giving centrality to the law, disregarding the recognizable influence of informal institutions and idiosyncratic details. More recent work focuses particularly on more subtle features of the state organization and social interactions (Acemoglu et al. 2014).

The latter vision seems to be more cautious on the matter. However, its treatment of enforcement is sometimes borderline naive. This failure is not exclusive to this field but it is shared by an ample range of legal and economic scholarship.

The meanings of enforcement Appellations to *enforcement* may carry at least one of two groups of meanings. Authors who support the claim for *natural* or *spontaneously* born rights, for instance, sometimes consider them *enforced* when they are

captured by the legal system and instituted as *legal* or *positive rights*. In this sense, enforcement is placed in the Humean world of *ought* (Hume 1738).[2] A different usage for the word *enforcement* points to a *factual* dimension. It equates *enforcement* to the *physical actions* put in motion to punish violations of the positive law or to force a person to fulfill a (positive) legal duty.

Another relevant distinction has to be made. Let us think of a socially undesirable genre of actions punished by a fine of $1. If every time that an individual instance of that conduct is committed, the fine is imposed (and even, collected),[3] it would be licit to say that that conduct, in general, is effectively enforced in that society. It would be predictable however, that such an enforcement mechanism would have no deterrent effect at all. Then, using the term *enforcement* with another meaning, others could say that the right contravened by that kind of actions is not *really* enforced in that society.

Polinsky and Shavell (2007), in a canonical work, try to encompass some previous dimensions by presenting a systematic and comprehensive economic theory of public law enforcement. They start by distinguishing private and public enforcement, the former meaning the bringing of suits by victims of harm or those threatened by harm. Then, state four major policy choices. The first, on strict *versus* fault-based strategies; the second, on the form of the sanction: Monetary *versus* non-monetary; the third, on magnitude of the sanction; and the fourth, on the investment devoted to choose the probability of detection.

Two comments can be addressed on this framework. First, the so-called private enforcement is in reality a complex set of elements among which private factors are as influential as public ones, enforcement-wise. Moreover, precisely the segment of procedure more strictly related to enforcement (post-judgment proceedings) usually consists of *public* rules, meaning that they are the result of public policy decisions and drastically restrained parties' will. This gives place to a second and more fundamental issue.

Public choices on strict or fault-based strategies give, as a result, legal norms. Nonetheless, they would rarely be considered a mere instance of enforcement, but ones of substantive law, meaning the law that establishes the rights and obligations of individuals. When, in 1935, California Legislature enacted an amendment to the Vehicle Code to include *negligent homicide* as a new crime, it was at least dubious that the result of its choice could be deemed a mere instance of enforcement. The same, when some state chooses to apply strict liability to a certain kind of harm. Categories are not, of course, ontological and therefore law and economics research is free to build those that deem more useful to its goals. However, the aforementioned methodological choices cast shadows on the limit between *enforcement* and *substantial law* seeming to leave no place for the latter. On the theoretical field,

[2]This usage of the term is not shared by scholars who reject the idea of *pre-legal* rights as a notion relevant for legal theory (broadly speaking *legal positivists*). Those who admit the natural or spontaneous origin of rights can and usually do, use the term enforcement in the second meaning too, in different contexts.

[3]This conceptual branch may be, in turn, split into one in which the fine is imposed *and collected*, and other wherein it *is not*. The latter is a good part of the following development.

almost every legal rule could be regarded as a part of enforcement and the economic theory of enforcement will be, in sum, the only economic theory of the law.

On the practical side, in many countries, constitutional legislative competence is assigned based on *substantial* or *procedural* quality of the law implied. Substantial law, in some of them, is only a federal parliament produce, while state legislatures are competent to enact procedural rules.[4] Legislative competence in administrative law is usually differentiated on the same basis. Then, it seems at least problematic, to evaluate under the apparently simple label of *enforcement*, different kind of legislative products.

Thus, as it is easy to see, conceptual issues and details of this complex mechanism are far from being irrelevant to this discussion. Effectiveness and the real-world effect of legal institutions is a function of that kind of minutiae (Cooter and Acciarri 2012). Development, in turn, aside the particulars of its meaning, is a set of real-world outcomes. Innovation, as a component of that set, is also an empirical phenomenon. Then, there is only an obvious step to conclude that the role of legal institutions on development, if any, is a function of their enforcement. Assuming that idea, deepening the study of the field, is relevant to every stream of thought on development and innovation.

The impact of legal rules on human conduct and enforcement deflection To describe their attitude facing the law we may think, naively, that individuals face a binary option: They can obey the law and keep away from any legal sanction or they can break the rules and suffer some negative consequences. Setting aside any philosophical considerations on liberty of human actions,[5] form a standard law and economics viewpoint this issue is seen as it follows: Legal rules are regarded as costly constraints to the private interest of agents computed at the time to endeavor an activity. If the legal system tends to efficiency, the smooth joint work of its pieces and human behavior will lead to maximize the social welfare or, in other words, to minimize the social cost. If the system points to different aims, the same could be said *mutatis mutandis*. In either case, the private cost imposed by the law to agents plays a key function in order to reach the system's goal.

Mainstream economic analyses of various areas of law usually assume premises of this kind. They take for granted that agents, facing legal institutions, endogenize enforcement in their private choices in a typical way: Individuals or firms engage in activities privately beneficial and take precautions up to the point that, computed the private cost imposed by the enforcement, maximizes their benefit or utility.

Enforcement mechanisms, assumedly, work in different ways. Sometimes, they attach a fixed sanction to a conduct, as in fines. Others, they assign a legal consequence of different measure to different levels of harm as in criminal or tort law. In these cases, relationship between levels of activity/precaution is assumed strictly correlative to levels of harm and levels of legal consequence's costs. In the former

[4]i.e., Argentina and Brazil. As it is known, there is a variety of schemes on the matter depending on the state organization.

[5]And some entanglement of Humean realms of *ought* and *is* that the previous statement conveys.

(fixed amount sanction), correspondence can be interpreted as linking a *range* of activity/precaution levels,[6] a *range* of *potential* harm and a *range* of legal costs.

Just for these purposes, let us think of enforcement as *the result* of an ample chain of norms and physical actions on human conduct. Within that framework, meeting efficiency[7] requires a peculiar functional relationship: level of harm, level of private utility/benefit and level of legal costs derived from enforcement (sanctions/legal consequences) must be functions of level of activity/precaution. Costs of legal consequences should be taken as a dependent variable of private activity/precaution levels under control of policy makers -in turn, judges, legislators or officials.[8] Mistakes in this first step of enforcement design and their consequences are easy to make up. If the private cost of those legal consequences is lower than the optimum, the level of harm will be socially excessive.

Nonetheless, enforcement is usually anchored not exactly in actual costs and benefits of activity/precaution levels but in a small set of formal proxies and generalizations: Depending on the case, some external and often easily monitoring properties or features of things, persons or actions, as typical actions, formal ownership, registered data, numerical thresholds and so forth. I will call them, in reference to enforcement, *anchor properties.* It is, for instance, overwhelmingly difficult to know, case by case, the private benefit derived from driving at an excessive speed and it is rather hard to calculate the correlative increasing in harm too. However, by means of some rough and artisanal generalizations, it is customary to assume that certain level of fines will cause a desirable deterrence. Thus, this first order of failures in enforcement design appears when actual relationships between those levels are incorrectly apprehended: in broad terms, e.g., when the speed limit is wrongly fixed and/or the fine's amount is too low or too high to generate the wanted level of deterrence.

A second order of flaws is still less apparent. Let us think of an enforcement mechanism properly designed in the previous sense but practically implemented by means of an automatic system capable to identify car plates but less exact at face-recognition. Thus, the cost of fining the registered owner of the car will significantly differ from the cost to fine the driver. Let us think, then, that the anchor property chosen by the designer of this first stage of enforcement (consisting in *imposing* administrative fines) is only *registered ownership*. Therefore, there will be cases in which the driver is not the registered owner of the car. Assume, too, that the car owner is not easily able to pass by the cost of the fine to the driver, either by legal or factual reasons. Hence, although there is not a failure in the first sense, there would be a universe of drivers under-deterred.[9]

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[6]A set of instances of conduct of the same class, i.e. car speeding, can be described as a range of conducts.

[7]The same applies to any alternative aim perused by the institutional framework. For simplicity's sake, hereinafter I will refer only to efficiency aims.

[8]Level of harm is also a dependent variable, but is not under control of policy makers.

[9]Anyway, a system of this kind could be even a good option in social terms. The social cost of under-deterrence could be less than the gains in reduction of monitoring cost.

There is nonetheless an even more elusive issue. Drivers-non-owners in the previous example are simply out of detection and then, factually immune to enforcement. Their exclusion, however, is entirely independent of their will. Unlike this scenario, let us think of another in which agents, in some way, can manipulate certain enforcement anchor properties. Think, for instance, of a hypothetical system designed to impose speeding tickets only once a year, and only to whom is the registered owner of the car *at that time,* independently of the time the infringement was committed and the plate detected. Changing ownership would be, then, a purposeful action that implies getting away with speeding. I will regard this kind of actions as sources of *enforcement deflection* and will discuss some outcomes of this effect in some detail.

Some remarks may be useful to characterize the notion of *deflection*. Manipulating anchor properties is always a costly choice. In the particular case of the example, it is easy to think of legal mechanisms tending to impede that easy way to escape. Nevertheless, enforcement is far more complex than this simple sketch. If we focus on *is* instead of centering on *ought* relations, the mere imposition of tickets does not make real impact in agents' utility or benefits by itself. Actual decreasing in utility/benefits relates to diminution of agent's wealth resulting of paying the ticket, either voluntarily or forcefully. Moreover, not even the loss of legal ownership of money or assets by itself necessarily alters those utility or benefits. What really affects them is the loss of *factual faculties to govern the employment of those resources*. If assets' formal ownership is assumed by someone else, but the former proprietor can still decide their actual employment in his or her own benefit, there is, in rough economic terms,[10] no loss of property rights (and consequently, no loss in utility or benefits) for the latter. On the contrary, the cost of that simulated transaction will actually impact on agent's incentives.

Enforcement deflection, according to the suggested meaning, is the outcome of costly actions tending to manipulate anchor properties and then, to dodge—partially or entirely—the impact of enforcement. It undermines the working of the system by altering the original relation between levels of activity/precaution and costs of legal consequences and then, given that agent's investments are not headed to increase precaution nor to decrease his or her activity level, but to reduce the private cost of legal consequences. Successful outcome of those actions, then, will increase the level of harm over the optimum. Actions tending to deflect enforcement can take place at whatever point of the institutional framework.

Summarizing,

- First, if an enforcement system fails in appropriately accounting relations between private levels of activity/care, levels of harm and costs of legal consequences, it will be a first order failure that turns it inconsistent with efficiency aims.
- Second, even succeeding in that first step, an enforcement system can also be instrumentally poor in order to reach its goals, if its picking of anchor properties

[10]For simplicity's sake I am disregarding reputation costs, symbolic effect et cetera.

for enforcement mechanisms is mistaken, as if they do not properly represent relevant levels of facts.

- Third, although those anchor properties appear, in a static view, correctly chosen in the light of system's aims, they can be more or less alterable by interested parties. I will assume that potential wrongdoers will regard acting that way as an option. The effect of that sort of actions on enforcement is treated here under the name of *deflection*.
- Fourth, the former issue, as long as the previous, generates problems not only of corrective justice but also of sub-optimal deterrence and a correlative increase in social cost. The latter kind of issues is nonetheless conceptually distinguishable from the remaining and relevant to institutional design.

Some aspects of institutional frameworks designed to deal with innovation are particularly vulnerable to enforcement deflection, which I discuss in further paragraphs. In the next section, nonetheless, I review in some detail and a little more formally, the problem previously insinuated as a particular and emblematic instance of this general effect I am calling deflection. That is, the problem of judgment proofness, statically and dynamically considered. More generally regarded, moreover, any successful action tending to escape from enforcement -i.e., to deflect it- make its author partially or completely judgment proof, as long as he or she enjoys of some immunity to institutional mechanisms.

3 The Treatment of the Judgment Proof Problem in Traditional Legal Literature and in Law and Economics Thinking

Insolvency is a classic topic in legal literature and a typical obstacle to some enforcement strategies. It is easy to see their most apparent outcomes according to the traditional legal view. On the one hand, form an *ex ante* perspective, creditors suspicious that debtors' solvency is insufficient, may ask for a risk premium. On the other, from an *ex post* viewpoint, creditors can only complain about their bad luck if debtors are insolvent at the time they must pay. Tort creditors (victims) are still in a worse situation, as long as they were never in position to choose to be so. Insolvent debtors are *judgment proof* given that the enforcement of those institutions would only impact their assets and, by definition, they completely lack of goods, or at least, their assets are insufficient to fulfill their legal duty. This scenario splits the answer about if creditors' rights are enforced or not depending on the meaning of the term *enforcement* involved in the question. Speaking from a pure legal perspective (*ought*), they clearly are. In regard to the real-world effects (*is*), they are not.

From a law and economics' point of view, the core-problem is subtly different. The focus of the issue is put forward, assuming that individuals take into account future states of the world to make their present choices. Law and economics literature usually treats the problem by means of a binary typology. Agents who own executable assets are of one type and those who have less than the needed to cover

their debts or completely lack them, are of the other. These types are regarded as stable and static (Calabresi G 1970; Cooter and Ulen 1997; Dewees et al 1996; Polinsky and Shavell 2000; Dari-Mattiacci and De Geest 2003).

Unlike this view, as initiated in previous research, a different treatment can be intended (Acciarri et al. 2005, 2006). The ensuing reasoning departs from a dynamic standpoint. Agents who lack assets cannot acquire them magically or effortlessly. However, agents who presently have some goods are sometimes able to shield their assets from legal execution. They will act this way as long as this option is acceptable from a cost-benefit consideration. Assuming this possibility enriches the framework of the analysis. On the one hand, its basis turns into a more realistic stance. On the other, it unveils a general feature of institutions. Legal rules not only deal with static types of individuals, but also face subjects who can manipulate their legal typology, cost-benefit wise. Integrating this apparently simple statement projects some divergent outcomes.

This perspective of analysis involves some instrumental steps. One of them is the need to consider legal and illegal actions in the same way, for they yield identical consequences. Let us start with the former. Either common law countries or civil law systems usually provide some exemptions to legal execution of assets. In the United States of America, there are exemptions as to what property can be taken and sold. For example, under some state laws, the homestead of the resident who is married or the head of a family is not subject to a judgment lien or an execution sale, with some exceptions. In most states, a judgment creditor may not garnish or execute against, social security payments, veteran's benefits, unemployment compensation, workers' compensation benefits, state police and teachers' retirement benefits, health, life of accident and disability insurance. In Latin American civil law countries, similar rules are in force. However, all these exemptions are in a sense static. Property is permanently covered by this exemption with no option to the owner to turn his or her assets into executable or exempted on his or her own.

Nonetheless, different legal rules give the owners the option to legally shield some goods according some conditions. Regulation of homestead rights may give a good example. In most North American states, the homestead exemption is automatic and one is not required to record a homestead declaration in order to claim the homestead exemption.[11] However, a few states do require such a recording. Something similar occurs in some provinces of federal South American countries. In Argentina, for example, while in Buenos Aires province homestead exemption is nowadays automatic,[12] other provinces still require voluntary registration. Details of the protection that each system gives also differ.

Besides these *legal* means of deflection, *illegal* ones also exist. In general terms the *doctrine of evasion* in Anglo-Saxon systems (in France, *fraude à la loi*, in Spain, *fraude de ley*, in Germany, *Rechtswidrige Umgehung eines Gesetzes*) encompasses indeterminate instances of improper manipulation of behavior to

[11]Homestead Declaration refers to a form filed with the county recorder's office to put on record one's right to a homestead exemption. A homestead declaration protects a person's home from being seized and sold in the event a money judgment is entered against him/her by a court.

[12]Law number 14432, 2012.

prevent mandatory provisions, displacing the normal operation of the legal system. There are, as well, typical cases of this illegal behavior. Property, to be executable, is required to be formally owned by the debtor. However, property rights in their economic meaning are something different from formal ownership (Alchian 1965; Demsetz and Alchian 1973). Conceptions on their nature involve some elusive features often disregarded. In characterizing this crucial notion, as suggested, statements of *ought* are usually invoked. However, explanations sometimes jump to *is* statements often inadvertently, as when probability notions are employed.[13]

This debate is not relevant to the present purpose nonetheless. To this aim, more than precisely characterizing the conceptual category of *property rights*, it is significant to point out that factual possibilities of action on some goods in fact exist, and they are relevant in the real world.

The expression *straw owner* names the person who holds title to the property for all legal purposes, but who acts on behalf of a hidden person who installed him or her as the legal owner. This practice itself, however, is legal but becomes illegal if used to hide assets from the courts and creditors or if it is used for money laundering, or to hide illegal gains. Commonsense disapproval of this conduct is based on *corrective justice* considerations. The emphasis is put on rectifying the injustice inflicted by one person on another's rights, leaving the victim with no compensation.

This situation, however, opens a broader gap in the system's effect, which has not been fully explored by law and economic research yet. Mainstream law and economics treatment, as previously suggested, deals with the judgment proof problem assuming a static stock of agents of definite type and derives some significant outcomes. This line of research has certainly proven fruitful but the scope of the research can be enhanced as well. A significant extension of the issue consists not exactly in focusing on the outcomes of *being* a judgment proof agent, but on the possibility of *becoming* an agent of that kind.

A quick review of mainstream law and economics conclusions on the *judgment proof problem* may be useful to this task.

The Judgment Proof Problem According to Its Usual Law and Economics Treatment The standard model of tort law analyses a scenario where an individual decides to undertake an activity that gives him or her, some benefit, and that can inflict harm on third parties with a probability depending on the level of precaution of the agent (Shavell 1987). To the present purposes, a unilateral accident's model will be of enough help.

[13]Demsetz and Alchian say "…What is owned are rights to use resources, including one's body and mind, and these rights are always circumscribed, often by the prohibition of certain actions… The strength with which rights are owned can be defined by the extent to which an owner's decision about how a resource will be used actually determines the use. If the probability is "1" that an owner's choice of how a particular right should be exercised actually dominates the decision process that governs actual use, then that owner can be said to own absolutely the particular right under consideration….." (Demsetz and Alchian 1973). It is easy to see that while the first statement pertains to the field of "ought" statements, probability statements, as the second one, are of the kind of "is" statements in Hume's taxonomy.

The simplest version of this model consists of the variables that follow. To make it easy the exposition, then, in italics, a summary explanation of the same ideas is given.

g stands for the benefit[14] that the agent obtains from the activity, being $g > 0$;
x is the level of precaution adopted by the agent.[15] It is assumed that $x \geq 0$;
$p(x)$ is the probability that the harm occurs,[16] being,

$$0 < p(x) < 1; p'(x) < 0$$

and

$$p'(x) \to -\infty \; when \; x \to 0$$

$$p''(x) > 0$$

h is the level of harm; assumedly, $h > 0$.

From a social standpoint, having in mind social cost minimizing goals, the optimal behavior of the agent can be expressed as maximizing an objective function defined as the difference between the benefit derived from undertaking the activity and the sum of precaution cost and expected harm, i.e.:

$$\max \quad g - [x + p(x)h].$$

x must meet the ensuing first order condition:

$$1 = -p'(x)h.$$

This condition expresses that precaution's marginal cost must equal the marginal decreasing of expected harm.

Optimum value of x is denoted by x^*. Additionally, for the agent to undertake the activity, the following condition has to be met.

$$g - [x^* + p(x^*)h] \geq 0.$$

[14]It can be a monetary benefit as in the case of the benefit of a firm or a simple increase in utility, even mere pleasure and not a rise in money in the case of an individual.

[15]The *level of precaution* is expressed in money units, so can be exchanged by *precaution cost.*

[16]As it is known, the expression *unilateral accidents,* assumes that causation of harm depends only on the tortfeasor. In a previous work, it was suggested that *unilateral causation* would be more precise to denote the same case. Indeed, the opposite (bilateral accidents) might not be clear. According to the common usage of words, either cases in which two agents cause harm each other or those where there is only a victim, but his or her harm is caused partly by him or herself and partly by the injurer, could be deemed *bilateral*. The apparent paradox to common sense is that the usual usage of the term addresses only the latter, being the former (probably the most "bilateral" in usual terms) a case of two unilateral accidents.

On this basis, under a legal rule that imposes the cost of harm entirely on the agent who undertakes the alluded activity (i.e. a strict liability rule) the social optimum x^* is met.

As long as the agent knows that his or her liability equals the value of the harm, he or she will include precaution cost and the cost of expected harm (equaling this cost his or her expected liability) in his or her objective function. Hence, the agent's chosen behavior will coincide with the socially optimum behavior. It is also demonstrable that, under the identical assumptions, a rule requiring a sub-standard behavior (i.e. a negligence rule) would lead to the same goal.

Summarizing, whenever the previously assumed conditions hold (level of harm depending only on the level of precaution of the agent who undertakes the activity, causation of harm depending only and entirely on the same person, cost-benefit behavior, et cetera) and the injurer owns executable assets enough to pay for his or her liability, either strict liability or negligence lead the potential tortfeasor to meet the socially optimum behavior. In other words, a potential injurer facing a potential liability judgment will invest in precaution measures until the cost of them (expressed in money or equivalent effort) equals his or her saving in liability. In the simplest framework, this conclusion holds either under strict liability or under negligence rules. On the latter, as long as the due care standard is set by the judge in the socially optimum level of precaution.

However if the injurer does not have enough assets to afford a potential judgment these conclusions change, and the liability system fails in its efficiency-seeking role. From the agent's private standpoint, precaution costs will be actual costs while any potential liability judgment will be, partially or completely, not a real cost to afford.

The outcomes of this issue are easy to notice. On the one hand, potential injurers will perform the same level of activity less carefully and/or—if relevant- will meet an inefficiently high level of activity. On the other, in more complex scenarios characterized by the influence of victims' behavior on his or her harm, they will meet an inefficiently high level of precaution. Victims' precautions will substitute cheaper precautions neglected by potential injurers at a higher cost. In any case, social cost wasteful increases.

In order to model a judgment proof scenario, a new variable may be included (Summers 1983; Shavell 1987). Let y be the level of executable assets of the injurer,[17] understood as an exogenous variable. When judgment proof injurers are involved, the condition $y < h$ holds. This means that, if the injurer causes harm for a value of h, he or she will only be factually liable up to y.

Given this constraint, the injurer's objective function becomes:

$$\max \quad g - [x + p(x)\min(y, h)].$$

[17]The *value* of those assets, indeed; h also stands for harm's *value*.

A judgment proof injurer will choose the level of care $x(y)$.[18] Being $y < h$, the level of care chosen will be sub-optimal in social terms and/or, in case, the level of activity inefficiently high. (Shavell 2004a, b).

Becoming Judgment Proof as a Rational Choice Beyond the simple treatment shown before, there is a good amount of literature refining the underpinnings of the analysis on the one hand, and proposing remedies to fix or (mostly) to mitigate, the undesirable social consequences yielding from that scenario, on the other.

Some scholars, for example, set negligence rule as typically superior to strict liability in the basic accident setting with limited wealth of the injurer (Dari Mattiacci and De Geest 2002; Miceli and Segerson 2003). Others, distinguish alternate technologies (Lewis and Sappington 1999); monetary and non-monetary precautions; introduce risk aversion considerations (Arlen 1992); asymmetric information (Innes 1999); litigation costs (Miceli and Segerson 2003); propose liability combined with regulatory remedies (De Geest and Dari Mattiacci 2002); mandatory insurance (Jost 1996; Polborn 1998); extension of liability to third parties (Pitchford 1995) or especial kinds of limited liability (Ganuza and Gomez 2004), as second best options of public policy.[19]

However, even these more refined analyses coincide in taking judgment proof agents as a fixed type of individuals. This assumption is not entirely realistic indeed. In real life, if a chance of becoming judgment proof with a net benefit turns up, a rational (and amoral) individual will take it. In other words, any solvent individual faces the choice of becoming insolvent, and this option influences some variants of enforcement and then, the very impact and effectiveness of the law, and the strength of rights.

Hence, the previous model can be easily reshaped to capture this option, by making the injurer level of assets an endogenous variable.

Let us suppose, then, that injurers foresee they will be able to alter their level of executable assets if they face a liability judgment. This option should reasonably be seen as costly -legal or illegal actions tending to shield assets will never be costless. However, its cost depends on the framework. This cost may be explicitly monetary and/or non-monetary. The latter, includes the risk associated to giving legal ownership to other subject (the straw person) opening the door to undesirable consequences with scarce legal shelter.

In any case, undertaking this kind of actions generates some costs and benefits. The most relevant advantage for the agent comes from the reduction of his or her executable level of assets, which puts a limit to his or her liability. From a social standpoint, this will induce the agent to take insufficient precaution.

On these assumptions, the expected "impact" (real-world value) of the liability judgment can be formally defined as follows:

[18]For the sake of brevity, this model includes some implicit assumptions. Sometimes, precaution cost is non-monetary. On the contrary, if it is explicitly monetary, executable assets would be only $y - x$. Additionally, it is also assumed that the benefit is either non-monetary or may be hidden at no cost. Otherwise, executable assets will be $y + g$.

[19]For a complete review of the relevant literature, see (Ganuza and Gomez 2004).

$$p(x)\alpha(c)h.$$

where α is the proportion of the value of harm that the agent is going to afford according to his or her level of executable assets, with $0 \leq \alpha \leq 1$, $\alpha'(c) < 0$ and $\alpha''(c) > 0$.

c, in turn, is the cost of making that proportion α lower than its previous level, being $\alpha \to 0$ when $c \to \infty$ and $\alpha \to 1$ when $c \to 0$.

If the agent's level of assets meets or exceeds the level of harm, the expression $p(x)\alpha(c)h$ coincides with the harm's expected value, being $\alpha = 1$.

In other words, the tradeoff between α (proportion of executable assets in relation to agent's liability) and c (the cost to diminish that proportion) clearly shows that the injurer has to choose how much to invest in shielding goods and how much in measures of precaution. The cost of the former usually decreases in function of two factors. Illegal actions of shielding, which are generally cheap in the presence of poorly designed or corrupted institutions and some legal actions, in turn, having the same effect. In relation to the latter, this cost frequently comes out as a side effect of institutions deliberately designed to different aims.

Including these new variables in the model, the objective function of the agent, under strict liability, is as it follows:

$$\max g - [x + p(x)\,\alpha(c)h + c].$$

In this scenario, there are two variables under the agent's control. In simple words, the individual has to decide how much to spend in precaution and how much, in diminishing formal solvency.

The first-order conditions of the problem are defined by the following equations:

$$\begin{aligned} 1 &= -p'(x)\alpha(c)h \\ 1 &= -p(x)\alpha'(c)h \end{aligned}.$$

The first equation sets forth that the agent must equal precaution's marginal cost with marginal decreasing in harm to reach the optimum. Notice that the latter will be a consequence of reduction in probability and/or magnitude derived from an increase in the level of care.

The second equation shows that the marginal cost of actions tending to reduce solvency has to equal the marginal decrease of the *share of the judgment to (effectively) afford*, in the optimum. Here, the sum to afford by the injurer drops as a consequence of his or her increasing in c, i.e., in the investment in actions addressed to reduce his or her solvency.

Solving this problem gives the optimum values of x and c, represented by $\tilde{x}$ and $\tilde{c}$.

The level of care $\tilde{x}$ in this case is lower than the socially optimum x^* as long as the potential injurer includes in his or her objective function only a share of harm's value. Only if $\alpha = 1$, $\tilde{x}$ would equal x^*.[20]

From the first-order conditions if follows that the optimum fulfills the ensuing relation:

$$\frac{p(x)}{p'(x)} = \frac{\alpha(c)}{\alpha'(c)}.$$

The previous results set forth an evident relation between x and c, say, between the investment in precaution and the cost incurred in order to lower the agent's formal solvency. Although raising any of them determines a reduction in injurer's private cost, the consequences of each kind of action are not equivalent to a social cost viewpoint.

While increasing investment in precaution does reduce third party harm costs, increasing the investments to lower solvency does not. The latter, in short, increases social cost and to sub-compensates victims of harm.

As long as we regard potential wrongdoers as rational agents, it follows that their choice on assigning resources to precaution or to reducing solvency depends on the net private benefit of that chance. Thus, if dropping formal solvency is relatively more beneficial than taking additional precaution, picking up the former over the latter will be the predictable outcome. This statement might be deemed close to trivial. However, there is not a systematic treatment of deflection as a general effect, in mainstream law and economics literature.

Analyzing, in fact, implies dissecting significant components of a problem to improve its comprehension. In this field, then, the study of some factors that lead to this outcome and their relations with certain institutional mechanism is far from being neither obvious nor inconsequential.

4 Some Sources of Deflection and the Institutional Framework of Innovation

Institutional fragility Institutional fragility is, indeed, a widespread but rather vague expression. In order to give a more precise definition Levitsky and Murillo (2006), propose to characterize the term negatively, as the absence of those attributes that define institutional strength. Institutions, in their view, are strong when the rules that exist on paper are *enforced* and stable.

Preceding remarks on the meaning of enforcement apply to this definition. Let us go back to the example of a rule enforced by an insignificant sanction, as the $1 fine mentioned beforehand, and let us assume that every instance of the ensuing action is effectively punished when committed. According to one of the several meanings

[20]This can be seen by comparing the first order conditions of this issue with the first order condition previously shown.

of the word, either in *ought* terms (and *on paper*) or in *is* ones (*on the world*), the rule has to be deemed enforced. However, that mechanism would rarely be effective to steer human actions to the aims of the enforced rule.

Yet, that is not an instance of deflection as defined in here. Enforcement mechanisms can be more or less effective to steer human conduct by different sorts of reasons. Deflection is only one of them that pervades an ample range of cases and, indeed, is a widespread effect in systems characterized by their fragility, but the previous example is not the case. The following are a few instances where deflection is included.

Deflection and corruption Corruption is a broad label to name a varied range of undesirable conducts. Some of them show instances of deflection as well. Let us think of a state license required to do certain activity. From an efficiency viewpoint, the permit is only a reliable signal that the agent fulfills the conditions required to perform certain activity in a socially worthy way. To make that signal effective, undertaking the activity without a valid license should trigger some enforcement mechanisms.

From the agent's standpoint, meeting the conditions to obtain the allowance is costly, as is bribing the official to get a license illegally. Again, investments in bribing are socially wasteful and deflect the impact of an institution. In this case, as previously highlighted, the cheaper the deflection private cost, the greater the social cost associated to that behavior. There is a vast literature (Becker 1968, Garoupa 1997; Polinsky and Shavell 2001) leading to consider corruption as socially undesirable because it dilutes deterrence. *Corruption* and *deflection* costs are not the same, but they have some significant relationship. Deflection may be carried out by bribing a state official but it can also be put into practice by means of illegal actions altogether different from bribing (as fraud, false pretenses or illegal simulation) or even by legal actions. Corruption, in turn, may be also the crime itself (as private usage of state assets), not an action intended to dilute deterrence.

Deflection and taxation There could be several reasons to impose different tax rates according to the size of business. Pure distributive justice reasons, on the one hand, or those that take into account (real or supposed) advantages derived from economies of scale, on the other, are clear examples of usual motivations. At the time that a decision on the matter is taken, there is a universe of actual firms, comprehending subsets of larger and smaller ones. Nonetheless, in a dynamic perspective, any large firm can be divided in two or more smaller ones and that decision depends on interested persons. Thus, as long as the legal mechanism allows the initially big firm to take that way at a small cost (all factors computed) the outcome will be predictable.

Letting open the possibility of undertaking some deliberate actions to enjoy the smaller tax rate opens up the way to deflection. An additional cue on this case might be pointed out. Being defection private cost less than the differential of rates, rational big companies will reorganize into small firms, and (theoretically) the subset of the former will become null or at least diminished. On the contrary, being that differential lower than deflection costs, no rational big firm will restructure.

The first scenario would provide the state no additional money as a result of the new tax rate policy.

Reorganization is a strategy well known among tax specialists and can follow paths either legal (*avoidance*) or illegal (*evasion*) that affect the collection of taxes.[21] There is no novelty on this. However, it is less frequently perceived that the same effect affects the magnitude or frequency of negligent harm, and has influence in other apparently unrelated areas of law.

Deflection and money laundering Legal provisions have enhanced the term *money laundering* to include several forms of financial crime and misuse of the financial system, many of them concerned with *destination* of funds though its primary meaning relates only with the *origin* of funds. In its narrower and original meaning, then, money laundering is usually defined as the process whereby the proceeds of crime are transformed into ostensibly legitimate money or other assets. In this sense, money laundering is not bad in itself but it is prosecuted as a means to deter the crime source of the funds (Buscaglia and van Dijk 2003).

In its strict meaning, money laundering raises a particular instance of deflection as described above. Cutting down the utility of dirty money is intended as a sort of second-order enforcement to fight against some economic crimes. In its theoretically perfect effectiveness, this mechanism would reduce the utility of dirty money to zero and then, the expected utility of a crime would fall to none. In the real world, it is obvious that full success is not possible and the issue turns into a matter of degree. Facing diverse regulations, turning dirty into clean money is a costly procedure. Getting back to the moment when potential criminals make their decision, the cost of converting the produce of their crime into formally legal (in economic terms, the cost of giving dirty money the same utility of clean money), would be computed by them. The cheaper this procedure, the more profitable the economic crime.

Money laundering, then, shows the same features of the judgment proof problem to this aims. In both, an interested agent can choose the level of investment to deflect the impact of the law or regulation, and comparing it with investment in level of activity/precaution. Raising the investment applied to the former increases the quantity of the socially undesirable conduct. It can be rational in private terms and socially wasteful in the same row.

This case is useful to illustrate two significant points. First, enforcement shows as the result of several layers of norms and material actions -making illegal the usage of money derived of crime is, in this case, a second-order layer tending to strengthen the enforcement against the original crime. Second, every phase of enforcement mechanisms is subject to deflection.

[21]Ancient highest court decisions as *Gregory v. Helvering*, 293 U.S. 465 (1935), by creating the "substance over form doctrine" in taxation, can be appreciated as increasing private deflection cost, as herein defined, and then, tending to fix this source of inefficiency. A brief discussion on the rival instruments to deal with this effect will be sketched in further paragraphs.

Deflection and forum shopping Let us assume that the right interpretation and application of law is given by the average interpretation of courts. Let us think, then, of high variance on court decisions and a system allowing a party to choose court with some degree of liberty. Being the defendant allowed doing so, details aside, actual deterrence will not be the average but the minimum associated to any of the judicial streams of thought. A general faculty of this sort would give place to a licit source of deflection. The more free the choice, the more reduced private deflection costs, and the higher the social costs of deflection. This possibility might be also related to further degrees of complexity. If some conditions are required for the option (e.g. domicile), and they can be (legally or illegally) manipulate by an interested party, the cost of the change will be equivalent to deflection costs.

All these examples are not new findings but well know problems in their respective areas of the law and public policy. Every specialist would deem any of them, problems affecting enforcement. There are, though, some features useful to point out a common effect underlying apparently unrelated situations. Differentiating this effect from other enforcement problems might suggest some lines of legal and economic analysis and certain public policy actions.

5 Some Issues of Public Policy

The ideas developed beforehand are not only theoretical insights but suggest some leads related to actions of public policy.

First, distinguishing deflection as a separate failure of enforcement mechanisms sheds light on different kinds of problems and remedies. An enforcement mechanism grounded on solvency (as liability or pure administrative fines) intended for a universe of agents originally judgment proof, is a failure detectable from a static standpoint. From a dynamic perspective, being foreseeable an exogenous shock able to turn a good part of the agents insolvent in the future, the option for that kind of mechanism will also be a failure, but of a different category. Moreover, none of those scenarios show defects of design related to deflection, so long as enforcement weaknesses implicated in them do not depend on agent's actions. A dynamic approach is a pre-condition to detect deflection instances but it is valuable itself.

Second, different kinds of enforcement failures are more or less prone to be fixed or at least relieved by means of different sorts of remedies, and depend on diverse amounts of information. Static malfunctions are usually a product of a primary misperception. In the static judgment proof case, for instance, data is visible and available, and require no sophisticated elaboration. Assessing the effect of future exogenous alterations (non-dependent on interested agents), needs a further step in complexity. Nevertheless, deflection problems require computing even more facts, on the one hand, and a rather refined knowledge on human reaction to minuscule details of law or regulation, on the other. Among the division of work concerning institutional design, economists usually deal acceptably well with transaction costs and have a superficial knowledge of legal details; lawyers, on the contrary, deal

better with legal technicalities but less so with the social outcomes of their combined play. Then, when complexity and dynamism increases, communication among different fields of knowledge (and action) tend to be noisy. Rough features of a rule (e.g. strict liability, negligence, criminal sanctions) can easily be integrated to a public policy measure assessment; minute details dynamically distorting its effect are far harder to be pondered. The debate, in practice, should desirably avoid the confusion of evaluating only ideal (rough) rules operating in static scenarios, because real public policy always faces dynamic scenarios plagued by details.

Third, some actions recommended to deal with static failures can even enhance their effect when dynamic malfunctions are taken into account. For example, Ganuza and Gomez (2004) suggest that softening negligence standards might be a good means to mitigate social costs coming from the presence of judgment proof agents. They primarily hold their point as a second-best solution for definite agents with limited assets, and then extend the same proposition in relation to a general population. They explicitly exclude from their analysis cases wherein *the level of assets can be altered or manipulated by the potential injurer.* The first sight intuition is clear: If agents can modify their solvency and the required investment in precaution decreases accordingly, they will have incentives to lower their solvency as much as possible.

This conclusion may be revisited from a dynamic perspective. The key on this point is *when* they are able to modify their level of assets. An originally solvent agent faces a choice between (present) investments in precautions required to meet the standard on the one hand, and (future and only probable) investments to deflect legal enforcement, on the other. The less required by the legal standard, the more attractive to pick the former over the latter. In turn, raising the private cost of enforcement deflection turns more attractive to invest in precaution as well. However, strengthening enforcement frequently requires costly state-run measures while lowering the standards shows up often less expensive. This reasoning projects some hints not only on negligence, but also on the social choice between negligence versus strict liability.

In mix populations, characterized by a sub-set of agents originally having limited assets and other consisting of individuals originally solvent, but having available a cheap option to deflect legal enforcement in the future, high standards of negligence might not be a good option of public policy.

Taxation examples show more corollaries of the same reasoning. Let us think of differential tax rates, based on the size of business. As previously mentioned, if the differential of rates is higher than the cost to deflect the superior tax impact (in the example, by dividing in two or more small firms) big entities will take the chance to deflect. This option implies higher social costs than the most visible, for the outcome of successful deflection is no collection of tax differential and the cost incurred to deflect the legal impact is dead weight in social terms. The same can be said on the example of mandatory state licenses: The higher the requirements to get

a legal permit, the more attractive to invest to deflect the impact of the legal institution requiring that license. Those investments, again, decrease enforcement, increasing, for the same reason, social costs.

However, prescribing less stringent legal requirements is not the dominant conclusion that the reasoning above supports. On the contrary, softer standards can relate to unreasonable levels of harm or, more generally, to unaffordable social costs. The hint that underlies is more subtle than a straightforward and unique guideline. It only points out a definite effect whose influence is usually far from being negligible and sometimes, resilient to intuitive institutional *patches*.

Although not every private actions intended to deflect enforcement are illegal, as it was shown, the usual patch that comes to mind in order to fix a detected source of deflection, is turning that action, or some of its variants, illegal. Policymakers sometimes try to fix detected instances of deflection or directly seek to reinforce primary enforcement by means of measures of this sort, which work as second-order enforcement. Turning illegal the produce of crime, as it was seen in the case of money laundering is an example of the latter. There are also some visible examples of the former. Debtors' prison is an old fashion institution generally banned by states. However, fraud is usually deemed a crime and it may trigger punishment of prison. Some actions tending to deflect legal enforcement (typically, shielding some assets) are usually included in crimes of that sort. Potential incarceration, in this case, plays a role of secondary enforcement: It works *as enforcement of the primary enforcement*.

These tools are not free from problems. Just to start, effectiveness of second-order enforcement depends on a second-order probability. In a simple tort case, e.g., the first step involves probability of being found liable for causing harm negligently and the second, probability of being incriminated for fraud, for illegally shielding assets. Combined probability is the product of both, then, the result is predictable a weak enforcement, moreover if, as modern economic analysis of criminal law suggests, probability is more relevant to motivate agents choice than the amount of sanction.

Then, there is not a unique dominant solution, but a bundle of options dependent on the case, technology and transaction costs structure of real societies involved. There are, nonetheless, identifiable genres of relations underlying. According to them, sometimes the best available option will be reducing the standards to make abiding the law more attractive than deflecting its impact. Others, substituting an enforcement mechanism with an alternative one, grounded on different anchor properties, will be the best to do deflection-wise. In different conditions, some procedural details matter, and some of them (e.g., shortening some terms, enhancing the role of provisional injunctions, giving the judge different powers) will increase the cost of deflection more than pretentious second order punishments based on criminal sanctions.

6 Innovation, Enforcement and Deflection

As it was shown beforehand, enforcement effectiveness and legal frameworks favoring innovation are customarily seen as determinant for economic development and, more generally, socially worthy by themselves. However, they are not always in as smooth relationship as desirable.

Enforcement's appropriate design requires some information on facts, acquirable from repetition; innovation, by definition, is a breaking point on a repetitive process. Relationships between levels of activity/precaution and level of harm, for a still non-existing product or procedure are, by definition too, unknown, and equally are the best anchor properties eligible to trigger enforcement.

Some peculiar instances of deflection can be analyzed in the light of that premise. Let us think of a technology B (for *bad*), worse (social cost-wise) than an alternative technology G (for *good*), for example, in terms of environmental expected harm. In the present state of the world, B might be generally associated to a set of anchor properties AP, perceivable at a monitoring cost clearly lower than the cost to fully evaluate the impact of B on environment. If enforcement aiming to discourage B, points to AP, agents will face an array of options. One is changing to G; other, to innovate, creating a new technology N (for *new*). N, nevertheless, can be *innovative* (broadly using the term) in two different ways. One of them, by being more beneficial in social terms, than B. Other, by only disassociating AP from B, but keeping the same harmful impact and accordingly, the same social cost, as B. The latter action, leading to an inefficient innovation, is captured by the notion of deflection.

Monitoring social costs, (a kind of costs included in administrative costs) and deflection social costs are often in tradeoff. Automatic detection of a small bundle of apparent anchor properties is usually cheaper, in administrative cost's terms, than substantial and complete evaluations of social costs, which require discovering the specific relation between levels of harm and levels of activity/precaution of a certain activity or technology. The latter is more robust to deflection, though -in other words, it is associated to less social costs of deflection.

The ensuing argument applies to different options of public policy. Subsidization to new technologies can be deemed acceptable or inacceptable according to different ideological grounds. If acceptable, however, that strategy requires picking out valuable innovation from other kind of novelties. Hence, realizing deflection risks, contributes to assess the full social costs of alternative enforcement schemes employed to carry out that kind of plans. This reasoning applies to *carrot* strategies (subsidization) as well as to *stick* policies (regulation or prohibition of harmful technologies).

Previous point might be easy to realize by mere commonsense reasoning even if no systematic consideration of deflection is made. However, it is worth considering deflection influence on issues much more elusive than this. In short, the more complex the aspect of enforcement frameworks focused on, the more refined conceptual toolbox is needed.

Let us think of policies dealing with a hard subject, as it is the risks of development defense in the area of product liability. According to a well-known definition, admitting that defense implies exonerating a producer on the basis "…that the state of scientific and technical knowledge at the time when he put the product into circulation was not such as to enable the existence of the defect to be discovered..." [22] That is a typical issue on the field of innovation. On the matter, some authors directly advocate for admitting risk of development defense as a policy to promote desirable innovation in spite its socially costly side effects. Other scholars, more technically, discuss the best rule to deal with new and still unknown risks, i.e. strict liability or negligence, under some conditions. Let us focus on a system dealing with that subject in terms of negligence. Boundaries of negligence and diligence must be determined by the judge according to the information gathered in the lawsuit and general scientific knowledge. Firms can push the frontiers of knowledge and discover new harms of their products as a side effect of unspecific processes or by systematic research. If they are subject to liability for negligence, they have no incentives to produce new information that reveals new risks, at least in the short run and under certain conditions. They have, moreover, incentives to hide information accidentally produced. Investment in hiding information about the matter will be typical actions that produce deflection -liability is anchored in *known risks* and the property of appearing *known* can be manipulated by the interested party.[23]

This is simple to learn, but public policy strategies to operate on that scenario are less than obvious though. As within the intentional insolvency case, a tempting empirical course of action is what I previously called second-order enforcement. That is, legal prohibition of hiding that information. The option between performing that conduct or not, can be studied, again, as a rational choice, conditioned by probability of detection and the private cost of the legal consequence. Debate on the information in hands of the producer, in turn, is conditioned to a legal complaint. The total private cost of the infringement, then, will be conditioned to a second-order probability -the product of probability of occurrence by probability of detection of the illegal hiding.[24] Therefore, a model of the kind of that barely sketched for judgment proofness, *mutatis mutandis*, could provide some help to the point much more efficiently than mere intuition. A second problem relates to administrative costs. Detecting and, in turn, sanctioning, a second-order infringement, requires additional administrative or judicial proceedings, with its respective social costs.

[22]European Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products (85/374/EEC), 7.

[23]There would be also incentives for some firms to cartelize under certain conditions, what is outside the scope of this work.

[24]Only for simplicity reasons I am intentionally omitting probability of detection of harm and other refinements.

Conclusions on this matter are simple. Comparison between enforcement strategies that implied second-order enforcement intended to patch chances of deflection versus others strategies than not, requires a proper calculation of every sort of costs implied in either of both and their appropriate aggregation. Distinguishing deflection as a separate source of social costs and focusing specifically in its outcomes and strategies to deter it, helps make that analysis more accurate.

7 Conclusions

A relevant part of the history of science consists in systematically dealing with phenomena known by common sense. *Scientific*, in this case, is almost equivalent to merely *systematic* or at least, to a specific kind of systematic study of things already known. In the field of social sciences in general and specifically in the realm of law and economics, systematic dealing with widespread and ordinary effects of human choices has been a usual part of literature. The role of administrative costs of any legal framework is evident, for instance, to every person. Its comparative assessment, however, requires a more careful approach -isolating them as a separate category to be thoroughly studied. Analysis, in this sense, separates layers of issues and detaches conceptual categories according to successive needs of better approach.

Social costs associated to enforcement deflection, as defined in this work, justify this approach. They are among several issues still not completely differentiated by literature. Enclosing them as a differentiable category might be a step towards its better treatment. Enforcement itself is still a too broad notion that encompasses elements of different sort. It is invariably deemed of maximum relevance but consensus on the field show insecure if not evanescent, when submitted to strict scrutiny. Innovation, in turn, is a positive, appealing and sometimes fainting notion, too. Relations between both categories, as it has been discussed, is less smooth than desirable.

Innovation shows, along this line, particular instances of deflection problems, and their regulation deserves technical precision. On this specific and practical side, the finer grained picture of a well-known landscape might help operate on reality. Rules that have proven effective in their original field turn into weak when face new technologies and accordingly, unknown relations between levels of harm and behavioral options. The answer sometimes tends to therapeutic obstinacy more than to a reconsideration of fundamentals. Strategies that merely rely on raising sanctions or imposing patches of second order enforcement can often fail that way.

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Part II
Case Studies on the Law-Innovation Nexus

The Legal Protection of Software in Japan—An Original Model?

Giorgio Fabio Colombo and Matteo Dragoni

Abstract

Since the early postwar period, Japan began to stand out as a leading global economic player, which thought of technological advancement as the primary way to catch up with the other developed economies. In particular, the computer industry was one of the fields in which the country showed and still shows its enormous potential. Due to the rapid strengthening of the sector, Japan was amongst the first States to be concerned with the protection of software programs, an unavoidable complement to its efficient hardware industry. As for the internal market of software, the Japanese situation had several peculiarities—partly owing to its complex language—and its software industry reflected such elements. Legislative proposals which took into consideration those uniquely distinctive aspects were submitted to the Parliament. However, under the pressure of the European Countries and the United States, the Japanese legislator enacted a regulation similar to the ones adopted by its main commercial partners. Copyright was chosen as the primary way of protection, while the projects containing a patent-based or a *sui generis* system were (at least temporarily) put aside. This notwithstanding said outcome did not imply the complete abandonment of the idea of software patenting. On the contrary, as such practice became more and more widespread around the globe, Japan led the way

Sections 1–4 may be attributed to G.F. Colombo, the remaining sections to M. Dragoni.

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and the authors try to investigate whether the Japanese judicial interpretations of the problem continue to show distinctive features.

1 Introduction

Japan is often associated with the ideas of progress and technology. The popular media often depict the country as advanced, whether it comes to news (Japanese robotics and newly-released videogames always making headlines in the Western media) or fiction (William Gibson, Ridley Scott and many others have taken Japan as inspiration or setting for their works). Of course, many Japanese hi-tech corporations are involved in the production and commercial exploitation of technical advanced goods (including software), hence the importance of their legal protection.

While the relationship between technology and innovation is obvious, and the link between law and technology is not difficult to investigate, the correlation between law and innovation may be less evident. This paper will also address how legal rules, innovation and technology are entangled in a peculiar "love triangle": this will be done through the lenses of software protection. Also, we would like to highlight the intellectual significance of law as a creative activity *itself*.

As it is well known, Japan is not one of the most widely studied countries in comparative law.

More than occasionally, the approach to Japanese law is characterized by an over-emphasis on the importance of "tradition". Japan has been variously identified as a Confucian, Eastern-Asian, mixed, or *civil law* legal system (Colombo 2013), but even the most advanced attempts of a proper taxonomy tend to revert to the somehow stereotypical depiction of Japan as a country where "tradition" (whatever that would mean) has an important role, and occasionally prevails over Western-style law (Örücü 2008).

On a more descriptive level, the country is often praised as a case of successful ground for legal transplants, as it was able to adopt and adapt foreign legal models in a Confucian (again, whatever that would mean) country. On the other hand, its depiction over-emphasizes Japanese "cultural uniqueness". The general picture of Japan in comparative law scholarship has been defined as "schizophrenic" (Ortolani 2009).

What is often overlooked is how the Japanese legal system is sometimes a careful choice (or transplant) of some convincing foreign institutions, but it happens also to be a synthesis, specifically tailored on Japanese needs and expressing an original model. This, to some extent, happened also in the case of software, when Japan tried to explore a "third way", alternative to both the US and the European model. The attempt, however, was partly revised and eventually dismissed (at least for the time being), as it will be explained later on.

Not only law, but also technology (and its protection) had a peculiar history in Japan. As it has been effectively explained (Heath 2005), during most of the Tokugawa period and especially during the period of isolationistic policy known as *sakoku* (1633–1853), the shogunal power was suspicious of technological improvement for it might have become a driver for social change. It came to the point, in 1721, to formally prohibit technological inventions. Yet, when the country

opened up again to the foreigners, achieving a swift progress in modern industry, craft, military technology was one of the key issues on the Imperial agenda. The motto *Wakon-yōsai* ("Japanese spirit, Western technology") became one of the leading principles of the Meiji Restoration, and Japan was effectively able to fill up the gap with more developed countries in the span of a few decades.

Since the early postwar period, Japan began to stand out as a leading global economic player, which thought of technological advancement as the primary way to catch up with the other developed economies. In particular, the computer industry was one of the fields in which the country showed and still shows its enormous potential.

Due to the rapid strengthening of the sector, Japan was amongst the first States to be concerned with the protection of software programs, an unavoidable complement to its efficient hardware industry. But before getting into the details of software regulation in Japan, it is appropriate to step back in time, to see how the contemporary Japanese legal system had its origin.

2 Minimal History of Japanese Law. Law as the "Barometer for Innovation"

In Japanese history, law was not important only to regulate or promote innovation. During some periods, law was central *as* innovation. To use the words of Kojima, the development of the Japanese legal system was seen as the "barometer" for Japanese development (Kojima 2004).

The creation of modern Japanese law happened somehow abruptly in the second half of the XIX century. Japan, under the military pressure of the American fleet, had to renounce its isolationistic politics and enter into a number of treaties eloquently known as "unequal". Under those international instruments, Japan had to concede many legal privileges to foreign powers, among which a preferential duty and taxation regime, the "most favorite nation" clause and extraterritoriality: disputes involving foreign nationals in Japan were subject to the consular jurisdiction. Western powers could easy find a philosophical justification to this latter imposition: the Japanese legal system, in fact, was deemed to be outdated and quasi-medieval, with the most significant collection of norms still being the *Kujikata Osadamegaki* of 1742. The Emperor Meiji, after bringing the power back again to the Imperial house (1868) realized that the modernization of law was a key factor to persuade other nations to review the treaties, and so he (and his bureaucratic elite) engaged in a forty-years struggle that led the country to have a modern systems of codes totally in line with the most advanced countries.

In this sense, it is important to underline how the protection of intellectual and industrial property had a pivotal role in the modernization of Japanese law. While of course those kinds of laws are not central to the building of an entire new system, in Japan they become central indeed when it came to the revision of the unequal treaties.

As mentioned before, law had a very important symbolic effect in evaluating the country's development. Yet, it would be extremely naïve to believe that development of the legal system *itself* could change a situation largely based on military pressure and *realpolitik*. While law was indeed significant in *complementing* Japanese innovation, what convinced Western powers that Japan was worth sitting at the table with other "advanced" countries were its successes in the military (in the Sino-Japanese War of 1894–1895 and then in the Russo-Japanese War of 1904–1905) and in the creation of an efficient industrial structure in the country. Still, the import of technologies and even just ideas from Europe and US stimulated a creative wave in Japan, and when the foreigners came to learn how freely intellectual works were used in the country, they immediately demanded for an internationally accepted protection. But Japan, in the span of only a few decades, was not anymore under the risk of being colonized and had made significant developments in its status: therefore the requests for a stronger protection of intellectual property were not accompanied by threats, but by promises to give the country a higher international status. The accession of Japan to the Berne convention was reciprocated by both the British Empire (1894) and Germany (1895) with the abolishment of consular jurisdiction (Ganea 2005). Somehow surprisingly, however, the same phenomenon is not observed in the field of industrial property, where, according to Heath, "foreign pressure played little or no role in the enactment and subsequent changes of industrial property laws" (Heath 2005, p. 408–409). The legal protection of creativity and that of technology had therefore a slightly different path.

3 Japanese Law, Comparative Law, and the Research for the Best Model

Although we briefly mentioned it, this is not the appropriate place to discuss the complex creation of modern Japanese legal system. Yet, before moving on to the core of this paper, another notable characteristic is worth mentioning. In general treatises about comparative law, it is often emphasized how Japan had a Penal code based on the French model, a Civil code based on the German BGB, a Supreme Court based on the US Federal Supreme Court, etc. All these assumptions tend to underestimate the effort made by Japan to create an original legal system. It is true that in some circumstances there were legislative episodes marked by rush (*i.e.* the first Penal Code, 1880) or by almost sheer imposition (*i.e.* the Constitution of 1947) and therefore the local product was not particularly original; yet, most of the times, the Japanese legislator tried to "digest" foreign models to create a legislation "fit" for Japan. Even the Civil code, which uses the very same structure of the German BGB, has some elements taken from French law, the British *common law* and two books (family and inheritance) specifically designed for Japan, taking into account and even somehow "inventing" local legal customs (Ono 1996, 1997).

Those extremely sketchy notes are given to trace a tendency marking a peculiar approach adopted by the Japanese legislator at the end of the XIX and never abandoned. It is remarkable how Japan is active in studying external models when it comes to update its legislation: basically no other highly developed country is so willing to model a new law based on some foreign experience. The open-mindedness of the Japanese legislator is almost surprising. Yet, it important to underline the creative approach that occasionally is adopted in Japan in creating laws going beyond the mere transplant, and this happened also in the specific field dealt with here: taking as example patent law, "while the initial patent statute was based on the U.S. law, the revisions of 1921 and 1959 marked a major shift towards the German patent system, while the latest examination guidelines are often the result of bilateral consultation between the European, U.S. and Japanese Patent Offices" (Heath 2005, p. 409). As it will be discussed, this is exactly the case also with software protection.

4 Intellectual Property: Reforms in the Japanese Court System

As we have seen, the fact that industrial and intellectual property are to be considered somehow "peculiar objects" is long acknowledged in Japanese law. Special objects require special protection, and therefore Japan, as many other countries, decided that disputes regarding those matters had to be dealt by judges with a specific expertise. One of the critical points in deciding how to handle those cases is how to equip magistrates with necessary technical information to fully understand the problems.

Already in 1948, in the framework of the Patent Act's revision, exclusive jurisdiction over claims against the decision of the Japanese Patent Office was given to the Tokyo High Court. Then, inside the same Court, a specific section was entrusted with this task. And so, in 1950 the 5th Special Division of the court became the "Intellectual Property Division". In the booming and swiftly developing postwar Japan, other sections were added, and in 2004 they were made independent from the ordinary civil division.

In 2005, all those sections were formally transformed into the "Intellectual Property High Court", thereby creating a specific separated branch for the management of IP-related disputes.

As it can be inferred from the preparatory works behind the legislation, the special jurisdiction was a necessary complement to the strive to create an IP-friendly environment, or, as the government put it, "an intellectual property-based nation" (Shinohara 2005, p. 133).

The Intellectual Property High Court is not a fully autonomous body; it has, however, a vast degree of independence, being chaired by a designated chief judge and staffed by specific administrative personnel. The IP High Court has a double jurisdiction: it could work either as first instance (mostly against decisions of the

Japanese Patent Office) or appeal (in case District Courts had to deal with administrative cases involving IP rights) tribunal for administrative cases. It may also be called to judge on civil IP-related disputes (involving patents, utility models, etc.), as appeal court. In this latter hypothesis, the first-degree jurisdiction lays on the Tokyo District Court for Eastern Japan and on the Osaka District Court for Western Japan.

One of the key issues in establishing an IP Court is how to ensure that judges are equipped with an adequate technical understanding of the problems. Japan has decided to solve this issue by providing the assistance of two categories of experts: the Judicial Research Officials and the Expert Commissioners (Shihohara 2005, p. 138–140). The former are full time employees entrusted with the research work necessary to fully instruct and understand each case. The latter are selected on a two-year, part-time basis among the leading experts in the country in their respective field, and provide to the Court technical advice on individual cases.

5 Software Patenting in Japan: Some Remarks

The Japanese legal system, despite the linguistic difficulties foreign researchers often encounter, has always attracted scholars in search of, real or more frequently apparent, peculiarities. With regard to intellectual property protection, it has already been anticipated that the Japanese model has little to offer to rarities' collectors, it being mainly a product of the U.S. and German influence over Japan, even if with several correctives (Kesan 2002; Kato 2011; Tokunaga 2011).

However, with regard to software intellectual property protection in general and in particular with reference to software patentability, Japan is sometimes viewed as an original "third model". The first two models would be the European and the U.S. approaches to the issue. The Japanese point of view is deemed important also because of the highly developed software industry and since a great number of computer-related inventions come from Japan.

In order to verify whether the Japanese system really contains peculiar provisions with regard to software patenting, a very brief historical digression on software protection in general and an overview of the other two "concurring" models are necessary.

Besides, in order to make this paper "readable", given the unavoidable technicality of the issues at stake, a short explanation of a few basic concepts related thereto will immediately follow. The authors are conscious that this insertion partially deprives the essay of its fluidity but they think that there is more harm in its omission.

- "Board of Appeal", *breviter* "BOA": it refers to one of the Boards of Appeal of the European Patent Office, which are in charge of dealing with the oppositions to the decisions of the Examining Divisions of the same.
- "Claim": one of the most important words in the world of patents is "claim". Every invention has to be accurately described by the applicant but what counts

the most is how the invention is "claimed". The claims define the extent of the protection sought and its admissibility. To a single invention usually correspond several (often dozens of) claims.

- "Description": a patent application usually contains a description of the invention, some claims, an abstract and, where needed, drawings. Some other minor elements are usually present (and are requested by the applicable law). The description, in particular, describes the invention, helping the examiner and the public in understanding its functioning.
- "Enlarged Board of Appeal", *breviter* "EBA": it refers to the Enlarged Board of Appeals of the European Patent Office, usually called to decide controversial matters
- "European Patent Convention", *breviter* "EPC": the Convention on the Grant of European Patents or European Patent Convention of 5 October 1973 is a multilateral treaty which institutes the European Patent Organization (seated in Munich), in charge of granting European Patents (through the EPO), supervising upon the EPC and of other tasks (through its Administrative Council). In particular, "the European Patent Organization is an intergovernmental organization that was set up on 7 October 1977 on the basis of the European Patent Convention (EPC) signed in Munich in 1973. It has two bodies, the European Patent Office and the Administrative Council, which supervises the Office's activities". The convention's present text was modified by the 2000 revision.
- "European Patent Office", *breviter* "EPO": the European Patent Office is one of the two organs of the European Patent Organization and acts as its executive body, it being in charge of granting European Patents.
- "Examining Division", *breviter* "ED": it refers to the Examining Divisions of the European Patent Office, which deal with the examination of patent applications. Each division is usually specialized in a particular field of technology and the patent applications are assigned accordingly.
- "Full disclosure"—"Exhaustive description of the invention": it is similar to one of the so called "discrete requirements for patentability" (novelty, non-obviousness, industrial application). If the description of the invention does not permit to the expert technician to recreate the same invention, then the patent cannot be granted. This requirement descends from the very purpose of the patent system, which is to disseminate knowledge about the inventions in exchange for the granting of an exclusivity period to the inventor. Thus the applicant has to exhaustively disclose every relevant detail of the invented process/product.
- "Idea/Expression Dichotomy": it is one of the main principles of copyright law, according to which copyright protection covers only the expression (for instance the way a story is written), while the idea underlying a work (the plot of the story) is freely exploitable. This principle receives different interpretations and readings.
- "Industrial applicability"—"Usefulness": Industrial Applicability, or Usefulness with regard to the U.S. law, is one of the discrete requirements for patentability.

An invention must not be the product of a lucky coincidence but it must be possible to reproduce it an unlimited number of times.

- "Invention": the definition of invention is one of the biggest challenges of patent law. In some legal traditions, it is referred to as "the new and original (technical) solution of a technical problem". This is why the concept of technical and technicality are usually associated to the word invention, even if the same meaning of "technical" is ambiguous and debated.
- "Inventive step"—"Non Obviousness": Inventive Step (EPC) or Non-Obviousness (U.S. law) is one of the discrete requirements of patentability. An invention, in order to be patentable, must not be obvious to the person skilled in the art. The purpose of this requirement is to prevent that minor advancements, indeed obvious to the expert of the field, become protected.
- "Novelty": Novelty is a patentability (discrete) requirement. In order to be patentable an invention must be new, i.e. not known to the public before the date of filing of the patent application or before the priority date. The novelty requirement prevents that known prior art be patented again.
- "Patent Eligibility"—"Inherent Patentability": the expressions "patent-eligibility" and "inherent patentability", in this paper, are used with the same meaning. They both refer to an evaluation of the alleged invention which precedes the analysis of the so called "discrete criteria of patentability", *i.e.* novelty, inventive step (non-obviousness) and industrial applicability (usefulness) (and, in a certain way, full disclosure or exhaustive description of the invention). According to the prevailing theory, inherent patentability should not be confused with the mere "patentability" of an invention. An invention is patentable if it is new, original and industrially applicable *and* it has passed the patent-eligibility test, *i.e.* it is indeed an "invention" according to the meaning that the single legislation confers to the word and does not fall entirely in one of the "excluded categories". They are "excluded" because, due to their nature or—more frequently—policy reasons, such discoveries are not considered proper "inventions" (mathematical formula, presentations of information etc. considered per se).
- "Software": the term "software" is usually referred to computer programs and their ancillary materials (instructions on how to use the program etc.). The expressions "software" and "computer programs", however, are here used interchangeably, assuming that the difference is clear.

6 Protecting Computer Software: Some Historical Details

When computer technology started evolving, soon it became clear that computer programs needed some sort of protection (Mahoney 1988; Bauer 2002). Scholars began to debate over which kind of protection best suited the software since the late Sixties, and the governments of the most industrialized Countries—as well as international organizations—appointed experts and commissions to try and understand the problem. Amongst these pioneers there were, in particular, the

WIPO, the UN, the United States of America, Japan and several European Countries, some of which reunited in the European Communities.

Even though, at first, a general consensus over which kind of protection computer programs deserved was not reached, various models were created by academics and international organizations (Machlup-Penrose 1950; Oelschlegel 1965; Senhenn 1968; Galbi 1970, 1973; Doi 1973; Kirby 1974; Kindermann 1976). In the meantime, all around the world national Courts were already dealing with the first software-related disputes.

In Europe, Article 52 of the European Patent Convention, which excludes software per se from patent-eligibility, was read by several national courts as an indication about "what-not-to-do". As a consequence, European Courts were more prone to include computer programs among the products protected by copyright law while excluding their patentability.

Some of the first European decisions, however, conferred protection only to the visual/graphic effects produced by the software (Sena 1983; Ghidini 1984; Levi 1984), which was initially compared to a cinematographic work (Tedeschi-Bracchi 1986; Ghidini 1987; Russi-Zeno-Zencovich 1988). Moreover, the approaches adopted vis-à-vis computer programs were very different in the States of the European Communities, which tried to harmonize the entire system with the first "Software Directive" of 1991.[1] The Directive provided that "*Member States shall protect computer programs, by copyright, as literary works within the meaning of the Berne Convention for the Protection of Literary and Artistic Works. For the purposes of th[e] Directive, the term 'computer programs` shall include their preparatory design material*".[2] With the clarification that protection shall apply to the expression in any form of a computer program and that "*ideas and principles which underlie any element of a computer program, including those which underlie its interfaces, are not protected*".[3] The "only" condition which is required for the computer program to be protected is that "*it is original in the sense that it is the author's own intellectual creation*".[4]

In the U.S., a proposal to protect software through patents was "precociously" submitted to the attention of the Congress in the early Sixties but the Presidential commission in charge of its evaluation concluded against such a legislation. Due to the intense lobbying against the patentability of computer programs, other similar proposals failed. On 12 December 1980 the U.S. Parliament decided to pass the Computer Software Copyright Act, which included software amongst the copyrightable works: copyright protection was established also within the U.S. even if the courts continued to debate over computer programs' patentability (HAYNES, 1995).

[1]See COUNCIL DIRECTIVE of 14 May 1991 on the legal protection of computer programs (91/250/EEC).

[2]See Directive 91/250/EEC Article 1.1.

[3]See Directive 91/250/EEC Article 1.2.

[4]See Directive 91/250/EEC Article 1.3.

In Japan (Karjala 1984, 1987; Uemura-Kato 2011), the first software decisions began to be issued since the late Sixties and, in order to clear the uncertainties, the Ministry of International Trade and Industry (*breviter*, MITI) appointed a special Study Committee on Legal Protection of Software, which issued an interim report in 1972. According to the report, copyright protection was inadequate for software. A year later, the Second Subcommittee of the Copyright Council set up by the Japanese Agency for Cultural Affairs submitted a report stating the opposite, i.e. that copyright law was the most suitable way to protect software, also because it required minimal changes to the legislation. After several years of debate, in 1983 the MITI was presented with another report in which a sui generis legislation to protect computer software was recommended. However, even if this solution had obtained a large consensus, under pressure of the U.S. and Europe, and upon suggestion of the Sixth Subcommittee of the Copyright Council set up by the Agency for Cultural Affairs, Japan decided to grant copyright law protection to software (Aranciba 2003).

In the end, especially thanks to the "*TRIPs Agreement*" (Article 10) of 1994, software received some sort of worldwide uniform protection through copyright.

7 Software Patentability

Notwithstanding the choice seemed to fall upon copyright protection, the international debate (Garner 2010) about software patentability did not cease (Bauer 2002; Bessen-Hunt 2007, 2008; Bakels 2011; Vasudeva 2012). The same TRIPs Agreement compels its Member States to grant protection "for any inventions, whether products or processes, in all fields of technology"[5] (the same wording which was later incorporated in the EPC), but is silent about computer programs (Pila 2005).

However, as already remarked, numerous scholars argued from the very start that copyright protection was insufficient and/or inadequate for computer programs. Some of them proposed that software had not only to be copyrightable but also patentable, while some others submitted that the best solution was to create an *ad hoc* intellectual property right for software-related products.

Theories of very different kinds and species (Leith 2007) were the basis for the debate (Chisum 1986). Several authors rediscovered and revitalized Locke's labor theory (Hughes 1988); some others invoked the weaknesses of copyright and trade secret protection due to computer programs' renowned peculiarities (Hilty-Geiger 2011, 2005); interoperability issues (Ghidini-Arezzo 2005) were highlighted to underline the inadequacy of the traditional patent system and the need of a completely new, dedicated, model (Samuelson 1984, 1985, 1990; Stern 1986, 1993; Menell 1994; Samuelson et al. 1994); the patent classification was considered outdated and perceived as one of the obstacles to an efficient and useful software patenting (Wayhan-Haase 2005); the development of the software industry and of

[5]See Article 27 TRIPs.

the small-medium enterprises was taken into account to sustain, at the same time, both the need of a strong patent system and to declare its enormous danger (Heckel 1992); strategic patenting, excessive fragmentation and duplication of low quality patents were seen as possible risks of following the classic patent model.

While the issue of software patentability was, and is, still under debate (Bakels-Bernt Hugenholtz 2002), the computer programs and the computer industry underwent a rapid and significant (r)evolution. As a consequence, administrative and judicial case law gradually began to adapt to a new understanding of the computer programs: software patents were granted and deemed to be valid (Arezzo 2012).

The approaches of patent offices and courts vis-à-vis software patentability were, and remain, slightly different from State to State and from patent office to patent office. The reasons may be found in the peculiarities of the applicable legislation, in the success of certain theories and doctrines more or less rooted in a legal system or of international prestige and, more frequently, in a combination of both aspects. It follows a brief, and necessarily simplified, overview of the solutions adopted in Europe and in the United States; afterwards the Japanese approach is examined more in detail.

7.1 Europe

As already mentioned, the European Patent Office had to deal with article 52 of the European Patent Convention, which states (in its revised version):

1. *European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application*
2. *The following in particular shall not be regarded as inventions within the meaning of paragraph 1:*

   (a) *Discoveries, scientific theories and mathematical methods.*
   (b) *Aesthetic creations.*
   (c) *Schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers.*
   (d) *Presentations of information.*

3. *Paragraph 2 shall exclude the patentability of the subject-matter or activities referred to therein only to the extent to which a European patent application or European patent relates to such subject-matter or activities as such.*

It is quite clear from the wording of Article 52 EPC that creations which contain a computer program can still be patent-eligible if the patent application thereto does not relate to computer programs as such. According to the EPO Board of Appeals (*breviter*, "BOA"), the exclusion contained in articles 52.2 and 52.3 would have its *ratio* in the lack of technicality of such categories of subject-matters or activities.

In fact, according to the BOA an invention would be the technical solution to a technical problem and such subject-matters would not possess, per se, any technical character. A definition of invention is not provided for in the EPC.

From the early Eighties the BOA tried to distinguish patent-eligible and patentable computer programs from their patent-ineligible and/or non-patentable counterparts. The task was not easy and the initial case law was full of contradictions and ambiguities[6] (Kolle 1991; Guglielmetti 1994). The BOA had to decide when a software-related invention possessed the sufficient technical character which made it patent-eligible under Article 52.1 EPC.

According to some scholars, the initial BOA decisions follow two different general approaches: the contribution approach and the whole-content approach. According to the so called "contribution approach", the patent-eligibility is established after a *prima facie* examination of the (alleged) invention's originality: the invention is inherently patentable when the invention's contribution to the art is technical and, in the majority of the relevant cases, it is not limited to a subject-matter excluded from patentability. On the other side, following the "whole content approach", if the invention is a mix of technical and non-technical elements, the patent-eligibility test is rapidly passed but the issue of excluded subject matter revives when considering the discrete criteria of patentability (novelty, originality and industrial applicability), and in particular the inventive step (*i.e.* originality). The invention is original, and thus patentable, if the contribution to the art is technical: the invention is the solution of technical problems or technical means are used to achieve such a solution. Even in this case, the contribution to the art is usually required to pertain to a field non-excluded from patentability.

Both the approaches (Guglielmetti 1996) were strongly criticized, with a considerable preference, however, for the whole-content approach (Newman 1997; Laub 2006). At the end of the Nineties, the BOA began to recognize, recurring certain conditions, the patent-eligibility of computer programs as such. Just some years later,[7] however, the BOA adopted an apparently more liberal approach when affirmed the (in principle) patent-eligibility of any software which is an integral part of a more complex hardware system: hardware, in fact, does not receive any kind of patent-eligibility restriction.[8] Whereas the computer program is the only inventive part of the invention, however, it has to be linked to the technical world and represent a new and original solution to a technical problem. Any software which is claimed per se has to possess such technical requirements, independently of its (often artificial) linkage to some hardware technology. In this case, however, the invention will undergo a more strict evaluation of patent-eligibility pursuant to

[6]See in particular the cases *Vicom* (T 0208/84), *IBM/CRI* (T 115/85), *IBM/Document abstracting and retrieving* (T 22/85), *SOHEI* (T 0769/92), *CPC/IBM I* (T 1173/97), *CPC/IBM II* (T 935/97) etc.

[7]See for instance *Auction Method/HITACHI* (T 258/03).

[8]See G 03/08, p. 40, Paragraph 10.13: *a claim in the area of computer programs can avoid exclusion under Articles 52(2)(c) and (3) EPC merely by explicitly mentioning the use of a computer or a computer-readable storage medium.*

Articles 52.2. and 52.3 EPC: before analyzing novelty and inventive step, the production of "further technical effects" has to be demonstrated. In fact, the software's production of routine technical effects, as the circulation of electric current within the apparatus, is not sufficient: "further" technical effects are required. Whereas the presence of such additional effects is not proved, according to the EPO Boards of Appeal the invention is a "computer program as such" and the patent application has to be rejected due to its lack of technicality.[9] This position—in partial contrast with a part of the same BOA case law—has been recently reaffirmed by the Enlarged Board of Appeals of the European Patent Office in 2010.[10]

7.2 The United States

The U.S. courts dealt with software (alleged) inventions in a different way, mainly owing to the fact that the legislation did not, and does not, contain any explicit provision restricting patent-eligibility.

Limitations to computer programs' patentability came uniquely from tests and doctrines created by the courts themselves, and some of which had their roots in 19th Century case law. In particular, an important case in computer programs-related matters was O'Reilly vs. Morse (1853),[11] in which the Supreme Court stated the general principle according to which "the mere discovery of a new element, or law, or principle of nature without any valuable application of it to the arts, is not subject of a patent" (Sheridan 1983). The practical application of such broad statement was not easy and additional tests[12] whose purpose was to verify whether or not computer-related inventions were really patentable were created: from the "machine or transformation" to the "useful, concrete and tangible result" test. Eventually, and after more than thirty years of debate, the U.S. Supreme Court declared that none of the tests created by the courts and used by the patent examiners could be completely relied on and that a case-by-case approach is

[9]See *Computer-related invention/VICOM* (T 208/84) *Document abstracting and retrieving/IBM* case (T 22/85); *Computer Program Product/IBM* (T 1173/97), *Auction Method/HITACHI* (T 258/03), *Clipboards formats I/Microsoft* (T 0424/03); *Loan System/KING* (T 1284/04); Opinion of the Enlarged Board of Appeal G 03/08.

[10]See EBA G 03/08.

[11]*O'Reilly vs. Morse*, 56 U.S. (15 How.) 62, 131 (1853) (Grier, J. dissenting).

[12]The evolution of the U.S. case law on software patenting may be read through some selected cases: *Gottschalk vs. Benson; Parker vs. Flook; Diamond v. Diehr; Diamond v. Bradley, Arrythmia Reseach Technology Inc. vs. Carasonix Corp* (958 F. 2d 1053, Fed Cir, 1992), *In re Lowry; State Street Bank and Trust Co. v. Signature Financial Group*, the *AT&T Corp v Excel Communications, Inc.* 172 F. 3d 1352, 1357 (1999); U.S. Board of Patent Appeals and Interferences (BPAI), *Ex parte Bowman,* 61 USPQ2d 1665, 1671 (Bd Pat. App. & Inter. 2001; *Bilski vs. Kappos* 130 S. Ct. 3218 (2010)*; Mayo Collaborative Services vs Prometheus Laboratories* 132 S.Ct. 1289 (2012)*; CLS Services vs. Alice Corporation.* (Fed. Cir. 2013); *Alice Corp. v. CLS Bank Intl*. (Supreme Court of the U.S., 2014).

necessary[13] (Chisum 2010–2011; Chiang 2011; Lemley-Risch-Sichelman 2011; Menell 2011; Thomas 2011).

Thus, software is patentable if it possesses the normal patentability characteristics (non-obviousness, novelty etc.), provided that the invention does not try to obtain patent protection for mere abstract ideas, natural phenomena or natural laws. The described solution seems simple but the software inventions' issue is far from solved: just between 2010 and 2014, several U.S. decisions tried to distinguish between (patentable) practical applications of the three excluded categories and mere attempts to monopolize abstract ideas, natural phenomena and natural laws with contrasting outcomes. A good part of the decisions declared the patents invalid but with the fierce disagreement of an important minority of the court. A relatively recent example is the *CLS Services vs. Alice Corporation* decision by the Court of Appeals, where it was stated: "*And let's be clear: if all of these claims, including the system claims, are not patent-eligible, this case is the death of hundreds of thousands of patents, including all business method, financial system, and software patents as well as many computer implemented and telecommunications patents. If all of the claims of these four patents are ineligible, so too are the 320,799 patents which were granted from 1998–2011 in the technology area "Electrical Computers, Digital Processing Systems, Information Security, Error/Fault Handling." Every patent in this technology category covers inventions directed to computer software or to hardware that implements software. In 2011 alone, 42,235 patents were granted in this area. This would render ineligible nearly 20 % of all the patents that actually issued in 2011. If the reasoning of Judge Lourie's opinion were adopted, it would decimate the electronics and software industries. There are, of course, software, financial system, business method and telecom patents in other technology classes which would also be at risk. So this is quite frankly a low estimate. There has never been a case which could do more damage to the patent system than this one*". Very recently, *Alice Corp. v. CLS Bank Intl* was decided by the Supreme Court of the United States, which confirmed the non-patentability of the claimed invention. Such a denial, however, did not cause (yet) the announced catastrophic consequences. Once again and foreseeably, the Court tried to focus on the case at hand, without setting general rules which could be harmful to, and generate chaos in, the patent system. Therefore, the issue is far from solved.

Moreover, also in the United States some sort of conflict between a contribution and a whole content approach took place. The European "contribution approach" was indeed similar to the American "point of novelty approach". After several years of debate, U.S. judges were ready to adopt a solution similar to the "whole content approach" when examining patents but, in practice, there were frequent occasions in which they intermingled the two methods of evaluation, creating ambiguities. In other words, while in Europe there was a long open conflict between the right approach to follow, in the United States the position of the courts became sooner quite unanimous "on paper" but its concrete application continued to show some incoherence.

[13]See in particular In re Bilski, 545 F.3d 943 (Fed. Cir. 2008) and *Bilski v. Kappos*, 130 S. Ct. 3218 (2010).

7.3 Japan

As already mentioned, the Japanese way of patenting software has been often seen as a third, alternative, model, somehow equidistant from Europe and the United States.

Similarly to the United States but differently from the EPC, the Japanese Patent Act[14] (*breviter*, "JPA") never contained any explicit limitation with regard to computer programs' patentability. At the same time, however, Article 2 JPA contains more complex and articulated patenting standards than the American (plain) 35 §101 USC,[15] since an invention is defined as "the highly advanced creation of technical ideas by which a law of nature is utilized" (Mashima 1999).

Very precociously, the guidelines for examination of the Japanese Patent Office (JPO) tried to distinguish patentable computer programs from unpatentable ones. The 1975 guidelines stated that software could be patented only when incorporated in an apparatus or a system. If on one hand the presence of a specific reference to software patentability clarified that computer programs could indeed be patented in Japan, on the other hand such a recognition was accompanied by a very restrictive requirement and the number of granted patents in the field of software remained limited.

Also in Japan, there were different theories regarding how, when and what to evaluate when determining the patent-eligibility and the patentability of a computer program. Two main, partially contrasting, theories similar to the contribution and the whole content approach may be found also in Japanese case law and patent examination practice.

JPO's first real opening towards software patent protection came around 1993, when the newly published guidelines allowed for the patentability of computer programs which performed all kinds of operations, both technical and non-technical, provided that hardware resources were *concretely* used by the program. It is in the same years that the JPO ceased to evaluate only the "original" part of the invention when determining its patent-eligibility: the originality requirement is considered only afterwards and not before determining the inherent patentability of the invention, which in a first phase is considered "as a whole". The so called "contribution approach"/"point of novelty approach" is from this moment onwards formally abandoned in Japan. The JPO guidelines further clarify that "[s]*ince the invention should be viewed as a whole, it is inappropriate to identify the claimed invention separating the aspect of artificial arrangement and that of automation technique*"[16] (Aranciba 2003).

In synthesis (Kawaguchi 2006; Takaoka 2011; Pessi Juho Antti Honkasalo 2012), according to the most recent JPO guidelines, computer programs are

[14](Japanese Patent) Law n. 121 of 1959.

[15]Precisely: "*Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title*".

[16]See JPO Guidelines for examination, Software Section, p. 15.

considered patent-eligible when they are "a creation of technical ideas utilizing a law of nature". Such essential requirement is met when: "(1) information processing by software is concretely realized by using hardware resources and (2) the information processing equipment (machine) and operational method thereof which cooperatively work with the said software satisfying the above condition (1), and the computer-readable storage medium having the said software recorded thereon are also deemed to be "creations of technical ideas utilizing a law of nature". To be more precise, a claimed invention must be concrete enough to accomplish a certain purpose, *i.e.* it "*must possess sufficient concrete means to accomplish a certain purpose and can be practically used,* […] *so that it is objective*".[17]

Moreover, Japan created a Software Patent Information Center, supported by SOFTIC—the system used to register software products, also for copyright purposes, in an ad hoc Computer Software Database (CSDB) —to allow a more efficient filing and a less difficult and aleatory examination of patent applications concerning computer programs (Matsuya 2011/2012).

7.3.1 Some Peculiarities of the "Japanese Way"

After this brief overview on software patentability in Japan, some aspects of the Japanese legislation and praxis about software patents are worth underlining, especially for comparison purposes.

First of all, it is important to highlight that in Japan there is an attempt to define the meaning of "invention" within the same patent law, which is something the drafters of the EPC and of the U.S. Patent Act always refused to do. In Europe, for example, the most successful definition of invention is "a technical solution to a technical problem", which had been borrowed from some (mainly German) scholarly positions and which was adopted by a strongly criticized EPO Board of Appeals: before its revision started in 2000, the EPC made no explicit reference to "technique" or "technical".

Secondly, there is a direct reference to the word "technical", which is nowhere to be seen in the US Patent Act and which, as already remarked, has been introduced in the EPC only after the signing of the TRIPs Agreement. The definition of what is and what is not technical, however, is not crystal clear also in the Japanese legal system.

Thirdly, there is an explicit reference to "laws of nature", whose patenting "per se" is absolutely prohibited in the United States according to the case law. In Japan, on the contrary, it is stressed that every invention—to be considered so—has to concretely make use of a law of nature. It is the (quite obvious) recognition that everything is linked to a law of nature and that its use is important to distinguish inventions (*i.e.* concrete and "tangible" applications of a law of nature) from mere concepts and ideas.

Fourth, the difference between process and product patents with regard to software inventions—a debated issue in many jurisdictions, including Europe and

[17]See JPO Guidelines, Software part, p. 11 and cfr. Hei 9 (Gyo Ke) 206 (decision 26 May 1999).

the U.S.—is immediately clarified.[18] According to the JPO guidelines, when a software invention "*is expressed in a sequence of processes or operations connected in time series, namely procedure, the invention can be defined as an invention of a process (including an invention of a process of manufacturing a product) by specifying such a procedure*"; on the contrary "*when a software-related invention is expressed as a combination of multiple functions performed by the invention, the invention can be defined as an invention of a product by specifying such functions*".

Moreover, it should be noted that Japanese courts, unlike their European and American counterparts, often refer to the examination guidelines of the JPO, which they take into great consideration. U.S. guidelines, for examples, are just guidelines for the examiners, based on the interpretation of the Courts, whose winding precedents are meticulously quoted and, to a certain degree, explained. The same happens with the EPO guidelines for examination, which are quite meticulous in justifying each passage with BOA precedents. The JPO guidelines, on the contrary, only rarely refer specifically to judicial decisions, quoting more often articles of the JPA, with abundance of examples regarding the different situations an examiner may face. This difference, however, is partially apparent, since the examples are frequently based on previously decided cases, whose factual aspects are cited without making reference to a specific decision. This notwithstanding, the fact that Japanese courts refer to the JPO guidelines frequently while the same guidelines refer to decided cases only in exceptional circumstances seems to suggest a different weight (if compared to U.S. and Europe) of the judicial decisions.

Moreover, it is worth noting that Japanese guidelines contain a special, very detailed, section on software-related inventions, of nearly eighty pages, which, as already mentioned, is of help not only to examiners but also to the Courts which approach computer inventions.

This being said, also the Japanese case law is not clear about the boundaries of software patentability (or, better, patent-eligibility), especially when computer programs and mathematical/business methods are intermingled, as it often happens[19] (Sfekas 2007; Yaguchi 2010).

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[18]See the definition given in the specific software-related JPO guidelines for examination (page 2): *(1) Invention of a process - When a software-related invention is expressed in a sequence of processes or operations connected in time series, namely procedure, the invention can be defined as an invention of a process (including an invention of a process of manufacturing a product) by specifying such a procedure.*(2) *Invention of a product—When a software-related invention is expressed as a combination of multiple functions performed by the invention, the invention can be defined as an invention of a product by specifying such functions*.

[19]See JPO *Guidelines for Examination*, 2012, pp. 11 and ff. available at the addreess http://www.jpo.go.jp/tetuzuki_e/t_tokkyo_e/Guidelines/7_1.pdf. See also, ex multis, (Gyo-Ke) case No. 10698 of 2005 (decision of 26 September 2006), (Gyo-Ke) No. 10239 of 2007 (decision of 29 February 2008); (Gyo-Ke) case No. 10369 of 2007 (decision 24 June 2008); (Gyo-Ke) Case No. 10001 of 2008 (decision 26 August 2008); (Gyo-Ke) Case No. 10056 of 2007 (decision 31 October 2007).

8 Conclusions

This brief survey of U.S., European and Japanese law and praxis about software patents, although insufficient to offer a complete and clear view of the problems related to computer programs' protection, is enough to allow some (also comparative) considerations.

It is undebated that software programs represented a "difficult subject-matter" from the very beginning and on a worldwide basis. More interestingly, however, software inventions gave rise to similar approaches in legal systems with very different characteristics and "starting points": the liberal (and common law) structure of the United States, the semi-liberal Japanese system and the (apparently) more restrictive European Countries which are part to the EPC.

The reasons of such an international convergence are numerous and complex. To name only a few of them, there is a similar common ground in the patent legislation —due to its extensive international harmonization—which has made the characteristics an invention must possess in order to be considered "patentable" practically the same. Local differences, although sometimes with significant consequences, remain but are confined to a few aspects and issues of patent law. Software programs, however, due to their "dual nature"—them being at the same time very abstract and very practical, source code and object code, expression and functionality—involve "patent-eligibility" considerations. And inherent patentability standards are not codified at a broad international level.

All this notwithstanding, problems, approaches and solutions of different legal systems, and in particular of the three most important legal systems as far as computer programs are concerned, tend to be similar.

Another (quite obvious) explanation may be found in the circulation of academic, legislative and judicial solutions and theories regarding this peculiar subject matter. For a certainty, the enormous amount of academic literature about software patenting favored a constant dialogue between distant and also less easily accessible (at least from a merely linguistic point of view) legal systems.

From such a premise—i.e. similar problems, similar approaches and similarly insufficient and/or inadequate solutions (as the current and persisting ambiguity and uncertainty would confirm)—some conclusions may be inferred.

The first one is that the Japanese model is not as original as it may appear from a prima facie investigation. Japan has tried to explore an innovative approach to software protection, but after some initial momentum lost its creative effort. Nevertheless, this aspect must not be overlooked: although the skillful carving of an original model was aborted, the intellectual problems behind this study were and still are very valid. In a world of intellectual property that was dominated by industrial technology (on the patent side) and by music and arts (on the copyright side) the idea that software was a truly new genus of (legal) objects deserving a peculiar protection was very remarkable.

The second conclusion is that software protection is one of the first realms where Japan tried to be a legal innovator because is also one of the first sectors in which the country was a technological innovator (hence, the reaffirmation of the "love triangle" between legal rules, innovation and technology). The relationship between the country and comparative law has often been characterized by Japan as an importer of models to be adapted to local reality. But, as mentioned, in this case the adaptation went a step further in the attempt to establish an original model. Japan could have led the way also because there is no "Japanese" software: as the object of regulation, software could be considered broadly the same everywhere in the world (but see supra). As an (unintended) side effect, the Japanese model could have been exported elsewhere: unfortunately, this will remain in the realm of ifs.

The third conclusion is that the above-referenced uncertainties in the legal protection of software seem to require some sort of intervention, preferably at a supranational level. All the previous attempts turned out to be inconclusive but maybe now, after more than forty years of debate, it is the right moment to return to discuss the matter of computer patenting harmonization; and this time starting from the fact of software patentability to better define the ceilings thereto and not from its theoretical possibility.

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Genetically Modified Seeds, Intellectual Property Protection and the Role of Law in Transnational Perspective

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Abstract

This paper tries to provide a fresh insight on a highly disputed, although very sectorial topic, represented by intellectual property protection on genetically modified seed and, in general, on agricultural biotechnology products. Both because of the wide employ of seeds and plant varieties in agriculture and for the international relevance of intellectual property protection, domestic perspectives on this very topic soon become obsolete, partial and useless. Intellectual property protection on agricultural biotechnology products is a charged topic for a number of reasons. First of all, seeds are the starting point of very complex value chains in all economies. That does not relate exclusively to food. Indeed, plants have now a role in a wide number of very diverse industries such as biofuels or textiles or construction materials. Most of all, seeds are indispensable for the production of vegetables, for a large part of the worldwide population the primary, if not exclusive, ingredient of the daily diet.

1 Introduction

This paper is a first attempt to provide a new legal perspective about the intersection of intellectual property protection and contract techniques to manage the use of seeds in agriculture, and, more specifically, genetically modified seeds that show resistance to pesticides, have higher yield and are less exposed to climate hurdles.

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There is a heated debate on biotechnology applied to agriculture. Intellectual property protection is one of the controversial issues involved, since the agro-business in most advanced economies is strongly incentivized by, and heavily relying on, patents. Less developed countries suffer from costly access to agricultural technologies needed to improve productivity. At the same time, such countries experience a paradox, since their territories are usually rich in terms of biodiversity and significant varieties. What can be eventually subject to genetic modifications and patented by large biotech companies comes indeed from those countries. Bio-piracy is one of those almost unregulated practices that end up being a serious wound for populations of less developed countries and a negative externality for the world population at large.

The main question that this paper aims to discuss is whether law as a technique to regulate and balance the interests of parties involved (farmers, communities, agro-bio companies) can have an effective role in governing the several models of agriculture and can be instrumental in supporting alternative business models that could co-exist with the current agro-bio business also in less developed countries. If law cannot be a factor of competitiveness for states (without triggering the usual race to the bottom), at least legal solutions can introduce strategies of differentiation among states, towards different models of economic growth.

2 The Problem: Intellectual Property Applied to Seeds

Seeds are an extremely important element of any eco-system as they are at the beginning of life, as far as the vegetal world is concerned. Access to seeds is a precondition for a number of farming activities which are primarily, but not exclusively, aimed at providing food to people. They include also the production of biofuels or of textiles and other critical raw materials. No matter how small a seed is, it is the initial ingredient of large, extended and complex value chains for all countries.

Because of the increase in the worldwide population and the alleged constant need for food, it has been thought that biotechnology applied to agriculture would have brought significant advancements in terms of pesticide resistant, high yield varieties that would have required less land, less water, less pesticides and less fertilizers to grow.[1] To achieve those purposes, technology can act, and has an impact, at different levels of the value chain of agriculture-based products.[2] Seeds are the primary asset and the starting point of the chain; acting at that level appeared

[1]The world population is expected to grow from the current 6.4 billion people to 9.3 billion in 2050, with a yearly growth of 77 million.

[2]For instance, researchers have been experimenting natural, eco-compatible polymers to reduce consumption of water. See, for instance, Demitri et al. (2013).

as particularly fruitful for agricultural biotechnology and techniques of genetic engineering have soon proved effective.[3]

The problem with biotechnological research (not necessarily referred only to the seed industry) is its cost and the need for expensive and complex instrumentation and procedures to deal with the extraordinarily complex structure of living organisms. Just as an example, researchers from the United States Department of Agriculture have recently announced the sequencing of the wheat genome. It has been an incredibly intense task, as it turned out that the wheat (*Triticum aestivum*) has between 94,000 and 96,000 genes, which is five times the size of the human genome.[4] Large investments have been made for an achievement that is an initial step to use genetic information to improve productivity and resistance.[5]

Unless states provide funding *ex ante* for intensive research and development activities mainly to public research organizations and academic institutions, most investments are undertaken by private companies that strongly rely on *ex post* exclusivity via intellectual property protection to ensure a return on investment for their research efforts.[6] In this regard, the evolution of the relationship between technology and intellectual property rights is no different from other fields, in all possible respects.[7] If, indeed, the private industry is championing the use of exclusive rights to ensure *ex post* incentives to investments in biotechnological research (with all the implications in terms of lobbying on governments in order to strengthen and possibly expand the scope of protection), small farmers and less developed countries protest against the use of intellectual property in this segment of agriculture and, particularly, on seeds.[8] Protection increases prices, that for the poorest populations is the real barrier in accessing seeds and, consequently, food.

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[3]But a ruthful critique to agricultural biotechnology comes from the influential work of Altieri (2015).

[4]See Brenchley et al. (2012).

[5]Bread wheat is a crucial crop for human life, since it accounts for 20 % of the calories consumed by humans. The current threat for wheat is a fungal disease identified as Ug99 (also known as stem rust), which is responsible for severe losses of crops in Africa, Asia and the Middle East since 1999. The study of the genome becomes instrumental to identify techniques that make wheat more resistant.

[6]There have been situations in which intellectual property protection has been sought also where the recurrence of an invention was doubtful, although investments for discovery had been significant. It is the case of the *Myriad Genetics* case, where the applicant tried to retain patent protection on two genes (BRCA1 and BRCA2) sequenced (an activity that required intense effort) even if the genes where not technically invented. See *Association for Molecular Pathology v. Myriad Genetics*, 569 U.S. (2013).

[7]At least in the United States, the federal government has had a crucial role in supplying farmers with seeds for over 100 years, before the private industry took over and started lobbying for increased intellectual property protection. For a detailed account of the evolution of the industry, see Center for Food Safety & Save Our Seeds, *Seed Giants vs. Farmers*, Washington, D.C., 2013, 13 (reporting that by the turn of the 19th Century the U.S. Department of Agriculture had distributed over a billion bags of seeds to farmers in the United States).

[8]The problem is not a new one. It had been already described by Busch et al. (1990).

Hard words are spoken and the difficulty of finding an equilibrium has been portrayed as a "seed war".[9]

Also from this perspective, things are apparently not different from other fields of the technology, and most remarkably in the field of software and digital creations. The assumption is that some resources (and, in this case, the germplasm of seeds) are commons and should be shielded by any attempt to extend proprietary rights on them. Yet, a closer look at the problem reveals that the situation is way more complex than in other sectors where supporters and critics of intellectual property protection are at war.

Access to seeds is considered a pre-condition for a number of practices in communities of farmers (mostly selecting the best seeds from the best plants, saving them for the next season—a practice also termed "brown-bagging"—and exchanging with seeds from other farmers), aimed at preserving biodiversity and increasing productivity by natural selection techniques. Across generations of seeds, varieties have been naturally improved and have become heritage of those communities. Such practices are basically inexpensive, not artificial (as cross pollination occurs naturally) and do not alter natural ecosystems where such seeds are employed. Most importantly, there are no exclusive rights at play that somehow constrain use. Actually, the exchange of seeds is an exchange of opportunities for improved local productions on smaller and larges scales.

Intellectual property protection kicks in when the selection process is triggered and achieved by means of biotechnological methods by manipulating the genetic information of the plant. The basic assumption is that the level of productivity should be increased and natural techniques of selection do not serve this purpose adequately (or timely, since they follow the time scale of nature and seasons). Moreover, because of atmospheric and bacteriological agents, plants should be made more resistant and genetic engineering is instrumental to that goal.

Exclusive rights applied to seeds means that the use of such fundamental ingredients of farming can (and in fact is) now heavily influenced by the intellectual property owner. Consequently, access to seeds is conditioned and practices of conservation and exchange of seeds become essentially forbidden to the extent they frustrate the interest of owners and do not earn their consent.

There are additional problems caused by the combined use of genetically modified seeds and intellectual property protection. First of all, since engineered seeds are resistant to pesticides, the selection process makes then dominant over time; other less resistant varieties are doomed to gradually disappear. In short, biodiversity is at jeopardy and varieties that may have important properties can get lost. Furthermore, since many agricultural regimes end up becoming monoculture, they are less resilient and intrinsically vulnerable to events and pests that might destroy them altogether. And since monoculture is at the opposite of rotation, land is doomed to a progressive impoverishment, which in turn justifies the massive resort to chemical fertilizers. Of course, biotechnology is at work here to make sure

[9]For an uncompromising reading see Shiva (2015).

that all this does not happen, but more resistant varieties come at the cost of more expensive access to protected technology; the problem, in a sense, is only postponed and the case for agricultural biotechnology is reinforced.

There are also ethical, technological and inevitably legal discussions about the opportunity of using transgenic varieties to produce food; science has not been able so far to clearly define whether there is a genuine risk for human health and for nature coming from use of genetically modified plants.[10] No matter how important this discussion is, its scope goes beyond the aim of this paper, which is to deal with genetically modified seeds from the perspective of the incentives created by intellectual property protection regimes and their impact at transnational level. After all, if given applications of biotech are risky for health it is not a matter that depends directly on intellectual property and the focus should be rather on the nature and results of biotechnology applied to food.

Intellectual property protection applied to genetically modified seeds appears problematic in a number of respects. As we have seen, exclusive rights provide the legal infrastructure for the industry to limit those practices that are at odds with the proprietary prerogatives and that would reduce the profitability of trade in seeds. Conflicts arise among supporters and opponents as in any other field of technology and there is a movement that equals seeds to commons and urges to reconsider the use of intellectual property in agriculture, where a commons regime is more consistent with agricultural practices, particularly in smaller communities of farmers. Moreover, there is also the suspect (somehow documented by evidence) that agricultural biotechnology is over-incentivized by intellectual property protection. The outcome is an apparent (and dangerous) diversion of the original purpose of the policy, which is no longer to support investments to improve agriculture, but to increase profitability, even when there is no technical problem to be solved, by artificially creating or reinforcing the rationale for biotechnological investments and, consequently, intellectual property protection.[11]

2.1 The Problem with Exhaustion of Rights

There is one peculiarity of biotechnological inventions that, when referred to genetically modified seeds, is a major source of legal problems for any patent policy, as well as for rights holders. Biotechnological inventions can refer to

[10]One remarkable case involves the production of transgenic corn in Italy. Until recently, there have been cases brought before administrative judges to challenge the decision of health authorities to deny authorization to put in commerce and employ in agriculture transgenic varieties. See, for instance, T.a.r. Lazio 23 Aprile, 2014, n. 4410, in *Ambiente*, 2014, 548, confirmed by Cons. Stato 6 febbraio 2015, n. 605 (not yet published).

[11]See Center for Food Safety & Save Our Seeds, *Seed Giants vs. Farmers*, cit., 15.

organisms that have the ability to be self-reproducing[12]; in other words, alike other inventions in different fields of technology, they are living matter.

The root of the problem is straightforward. The general rationale behind intellectual property rights is simple: imitation of a protected item is infringement. Protected items can be bought and used and even resold downstream or donated, but cannot be generally reproduced without permission of the intellectual property owner. The first sale of a protected good causes exhaustion of protection, in connection with the payment of a consideration (a supra-competitive price) that is supposed to compensate the inventor for its investments. Typically, exhaustion does not affect the limitation to create copies of the protected items, even if such items have been lawfully acquired in exchange for a price.

But what if the protected technological good can create copies of itself, by reproducing the features that are subject to patent protection? Does the exhaustion effect still take place or it never does? And in the latter case, can the patent owner control the technology all along the value chain, no matter how it is used, by whom, how many times, for whatever purposes until the patent is in force?

These interrogatives are clearly technology-specific; they refer to biotechnology and, as far as genetically modified seeds are concerned, they pose a serious issue for patent policy.[13] Limiting protection to the first sale would be probably not enough in terms of incentives for the agro-bio industry. On the other hand, accepting the fact that protection is never exhausted turns out to be a multifaceted problem, first in terms of overprotection and costs that the public at large may be called to bear, second for the discrimination among technologies, that could have an impact on industries and markets.[14] This is a puzzle that requires legal solution and although each legal system can come up with its own solution, the consequences and the effects of each choice can go well beyond the national borders. Regulation can have direct internal impact (benefitting the intellectual property holder or farmers), but it has also certainly external effects by influencing at transnational level the choice of the industry to commercialize given technologies and to extend the operations in given countries. In this respect, the link among intellectual property protection, international trade and foreign direct investments is clear and strong. Regulation of

[12]This feature is recognized as structurally distinctive for biotechnologies; see for instance art. 2, par. 1, lett. (a) of European Directive 98/44/EC.

[13]For a discussion on the alternative options, see Downing-Howk (2004).

[14]One remarkable difference that emerges in considering exhaustion of rights relates to software, that, alike seeds, is not self-reproducing but, like seeds, can be "generative" of further products by preserving a constant trait. Quite interestingly, the U.S. Supreme Court held that a sale of a product that incorporates a software process technology causes the exhaustion effect. See *Quanta Computer, Inc. v. LG Electronics, Inc.*, 553 U.S. 617 (2008). For a comment on the decision see also *The Doctrine of Patent Exhaustion: The Impact of* Quanta Computer, Inc. v. LG Elecs., Inc., in 14 *Va. J.L. Tech.* 273, 283 (2009). Software and seeds have been considered showing some common traits by Leaven (2008), that criticizes the different conclusions on exhaustion. But the argument of similarity goes back to the opinion of the advocate general Mischo in the European case *SPRL Louis Erauw-Jacquery c. La Hesbignonne SC* (in *ECR*, 1988, 1919).

intellectual property has effects on other policies and affects other aspects of the market.

More importantly, if exclusive rights are persistent for self-reproducing technologies, the right holders can continue ruling about the way the technology can be used, thus perpetuating their will (not only their exclusive rights) downstream and imposing models to users that might further limit farmers' freedom. This power might go well beyond what is needed in terms of incentives for the industry.

3 Contracts for the Circulation of Genetically Modified Seeds

Intuitively, coupled with the problem of patent protection for genetically modified seeds is the use of contracts to control the value chain by intellectual property owners and to reduce the risks of farmers' behaviors that would seriously harm the protection and reduce the profitability of innovative technologies.

Proprietary protection is a necessary condition to be rewarded and receive incentives to invest in genetically modified varieties. But it is not sufficient. The intrinsic limitation of exhaustion is, so to say, a genetic trait of patent protection, and a very troublesome one. Moreover, there are several farming practices that require a further level of restriction not allowed by patents, but certainly available through contractual terms. Since exhaustion effects come from sales, and sales are contracts, one way to control circulation is precisely to act on sales terms and conditions, by conforming the use of purchased seeds to the commercial strategy of the rights holder.

To fully understand the use of contract to control the circulation and the use of seeds it is worth recalling that genetically modified seeds are commodities bought by farmers for sowing. What is protected is not the seed *per se* (that is, the portion of physical matter), but the process technology that is responsible for the definitive modification of the germplasm as it results in the genetic information eventually contained in the seed.[15] Purchasing the seed also implies accessing the technology, which is an inseparable feature of the seed.

In order to prevent exhaustion of patent protection that insists on the technology, the agro-bio industry has come up with an ingenuous mechanism that relies on contracts. Thus, when farmers buy seeds in bulk (typically packed in bags of different size), the transaction is construed as a complex contract that blends a sale (of the seed as such) and a license (of the incorporated proprietary technology).

Terms and conditions of the license are typically fine-printed on sealed bags and a more specific clause warns purchasers that opening the bag and using the seeds signifies acceptance. Those familiar with software technology contracts will recognize a mechanism of contract formation that is analogous to shrink-wrap licenses and that might raise the same doubts about the meaning of the consent exchanged

[15]Because of the nature of technology (a process), protection extends to the outcome of the process, that is the genetically modified seed.

(to be sure, the mechanism is also termed "bag-tag" or "seed-wrap" licensing, by analogy with other –wrap like agreements).[16] Patent and technology owners are thus able to impose unilaterally contractual terms to the purchaser that is at the same time a licensee of the technology subject to rights and obligations concerning its use.[17]

More in details, contract terms require the farmer to use the seeds only for one season and not to replant second generation seeds (that is, seeds that come from plants that are grown by sowing the seeds purchased in the first place). Moreover, the farmer cannot exchange the seeds with other seeds, whether his own or third parties'. If seeds are exchanged and used for replanting, the recipient of the seeds is an infringer (because patent protection is still effective and the terms of the agreement are enforceable), while the provider is in breach of the license. The recipient can then be pursued not on contractual ground, because technically there is no relationship between him and the technology owner (no privity), but because he is accessing a piece of intellectual property without consent where the protected feature is still subject to exclusive rights. All these contractual prohibitions are made possible by the fact that the first sale (that includes a license) has not technically caused exhaustion.[18] Here again, it has to be recalled the difference between biotechnology and software technology.[19]

Once purchased, seeds are then used for sowing, but since plants coming from seeds yield seeds on their turn, and the variety is genetically modified, the next generation of seeds is identical to the former and still featuring the proprietary traits. Needless to say, exhaustion is prevented by the fact that the embedded technology is licensed and not sold and contractual terms can introduce in the contractual relationships the whole set of limitations that have been previously mentioned.

To a mind not exposed to legal sophistications, such mechanisms can appear as artificial and complex; and so they are. Their effectiveness results from the combination of proprietary rights and contract techniques whose immediate outcome is

[16]The seed-wrap licensing practice has been approved by a number of lower courts in the United States and then affirmed by the U.S. Supreme Court in *J.E.M. v. Pioneer*, 534 U.S. 124 (2001) at 145.

[17]The context is of a typical business-to-business transaction, with standardized terms unilaterally written and imposed to farmers by the owner of the critical (intellectual property protected) resource.

[18]The International Seed Federation has expressed its view on the topic of exhaustion by stating that there should be no exception for farm-saved seeds under any form of intellectual property right (see *ISF View on Intellectual Property*, Rio de Janeiro, 2012, 26).

[19]And it is a difference that comparatively is stronger in Europe than in the U.S., after the ECJ decision in *UsedSoft GmbH v. Oracle International Corp.* (ECJ 3 July 2012, C-128/11), that has interpreted the European directive on software as meaning that the right of distribution of a copy of a computer program is exhausted if the copyright holder who has authorized, even free of charge, the downloading of that copy from the internet onto a data carrier has also conferred, in return for payment of a fee intended to enable him to obtain a remuneration corresponding to the economic value of the copy of the work of which he is the proprietor, a right to use that copy for an unlimited period. For a comment, Göbel (2012).

to perpetuate patent protection across generations of seeds and to subject farmers to the intellectual property rights of the growers.

The combined effect of contracts and property comes at the inevitable cost of forcing contracts as mechanisms to control circulation and use of seeds. The mechanism is effective to the extent the terms and conditions of the agreement are enforceable, but the enforceability has to be tested against legal theories on contract formation at national level. Since contract law is still largely national, the viability of contractual solutions by intellectual property owners cannot be affirmed once and for all legal systems. Although there is a trend to consider such arrangements as valid, still occasionally some courts might object to their enforceability.[20]

As a matter of fact, through the mentioned combination of intellectual property and contracts, the agro-bio industry is able to retain absolute control of the value chain and to extend its powers to connected market (such as that for chemical products, including pesticides, herbicides and fertilizers). Going back to the mainstream arguments of the debate, without intellectual property there would not be any new genetically modified variety. If exhaustion effects worked as in any other instance of intellectual property protection, the incentives would be reduced (if not eliminated), as the first sale of a self-replicating technology would then make it available to anyone at no cost. The use of seed-wrap licenses relies on, and at the same time reinforces, patent protection on seeds.

Negative externalities are apparent. Without intellectual property protection, downstream activities implying the use of seeds would be unfettered and common practices of saving, exchanging and replanting seeds would be perfectly lawful. Resort to intellectual property is a real game changer and a large part of negative effects (starting from loss of biodiversity) comes from the operation of this mechanism and should become part of the equation for balancing grants of exclusive rights with social benefits to access.

4 Normative Framework that Applies to Genetically Modified Seeds and How It Deals with the Problems Above

The agro-bio industry has an interest in applying uniformly the solutions devised at contractual level to prevent exhaustion, reinforce intellectual property protection, manage risks and increase profitability. In a globalized world, such solutions can be seen as a genuine expression of a new *lex mercatoria* or, more brutally, the attempt of multinational corporations to opt out from a legal system and to impose their own laws. To the extent national courts enforce such contractual arrangements, they give a pass to them to freely circulate in the market as legally viable solutions and to propagate into other legal systems (when circulation of models is path dependent).

[20]For a discussion of techniques of contract formation in comparative perspective see Granieri (2015).

Pressures to modify intellectual property laws in a more favorable way to industry, although powerful (because of the lobbies), have limited effect since international treaties within the Word Intellectual Property Organization require consensus, that is more and more difficult to obtain for the opposition of those countries that are negatively affected by the practice of multinational corporations.[21] On the other hand, contract law remains mostly a national matter and it shows more flexibility; empty spaces left by legislators can be easily filled in by private ordering and freedom of contracts.

The legal question then is to see which are the limits of private autonomy when dealing with intellectual property protection on genetically modified seeds. The question does not have a general and abstract answer. It must be dealt with still under the state laws where contracts are used by the industry to engineer solutions that are consistent with its own goals.

In a number of recent cases, Monsanto—which is one of the few large multinational corporations in the field, epitomizing the archetype of the globalized player in the agro-bio market[22]—has been testing for some time now from a legal standpoint the enforceability of its contractual arrangements for the distribution of patented genetically modified seeds. In particular, the company owns patents related to soy modified with DNA-recombinants techniques that make the seeds resistant to herbicides and, more specifically, to glysophate-based products (also patented and sold by the same corporation).[23] This technology is worldwide known as the Roundup Ready®.

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[21]As a matter of fact, the Doha Development Round negotiations started in 2001 are still blocked and agriculture is one of the most relevant dealbreakers.

[22]According to some sources, Monsanto is responsible for the commercialization of 90 % of all genetically modified organisms worldwide. It has been also the topic for a documentary by Robin (2015), where all the major critiques towards the company are counted by the author.

[23]In at least one case, Monsanto's patent claims are direct to a method for controlling weeds with its technology. See US patent n. 5,352,605 its reissue RE39,247 (claim 32): «A method for selectively controlling weeds in a field containing a crop having plant crop seeds or plants comprising the steps of: (a) planting the crop seeds or plants which are glyphosate-tolerant as a result of a recombinant double-stranded DNA molecule being inserted into the crop seed or plant, the DNA molecule having: (i) a promoter which functions in plant cells to cause the production of an RNA sequence, (ii) a structural DNA sequence that causes the production of an RNA sequence which encodes an EPSPS enzyme having the sequence domains: -R-X.sub.1-H-X.sub.2-E-(SEQ ID NO:37), in which X.sub.1 is G, S, T, C, Y, N, Q, D or E; X.sub.2 is S or T; and -G-D-K-X.sub.3-(SEQ ID NO:38), in which X.sub.3 is S or T; and -S-A-Q-X.sub.4-K-(SEQ ID NO:39), in which X.sub.4 is A, R, N, D, C, Q, E, G, H, I, L, K, M, F, P, S, T, W, Y or V; and -N-X.sub.5-T-R-(SEQ ID NO:40), in which X.sub.5 is A, R, N, D, C, Q, E, G, H, I, L, K, M, F, P, S, T, W, Y or V, .Iadd. provided that when X.sub.1 is D, X.sub.2 is T, X.sub.3 is S, and X.sub.4 is V, then X.sub.5 is A, R, N, D, C, Q, E, G, H, I, L, K, M, F, S, T, W, Y or V.Iaddend.; and (iii) a 3' non-translated DNA sequence which functions in plant cells to cause the addition of a stretch of polyadenyl nucleotides to the 3' end of the RNA sequence where the promoter is heterologous with respect to the structural DNA sequence and adapted to cause sufficient expression of the EPSPS enzyme to enhance the glyphosate tolerance of the crop plant transformed with the DNA molecule; and (b) applying to the crop and weeds in the field a sufficient amount of glyphosate herbicide to control the weeds without significantly affecting the crop».

Monsanto uses a double channel to distribute its products: directly via farmers and, indirectly, via growers that are responsible for duplication and sale to farmers. In both cases Monsanto uses a standard form contract, called the Monsanto Technology Steward Agreement (Monsanto TSA) under which the several technologies owned by the company are licensed to growers and farmers. Monsanto TSA is a single-use license, meaning that the purchaser of the seed is allowed to use the seeds «solely for a single planting of a commercial crop» (art. 4.f). Additionally it introduces a number of limitations concerning saving, transferring, cleaning or conducting research on patented seeds. Second generation seeds (those obtained by planting the purchased seeds) can be sold as commodity seeds to local grain elevators, that typically do not suffer limitations in reselling such seeds.

In the U.S. case *Monsanto v. Bowman*, a farmer had bought for years patented seeds from growers licensed by Monsanto, complying with the licensing terms. Due to the need of a second (and riskier) sowing in the same year, Bowman starts acquiring lower price seeds from a local elevator and starts mixing those seeds with third generation seeds (clearly breaching the terms of the Monsanto TSA).[24] When Monsanto brings an action against Bowman, the farmer raises, among other things, the defense of exhaustion of rights: purchasing seeds from those who do not suffer limitations (such as grain elevators) should trigger the application of the first-sale doctrine and return freedom of operation to the farmer.

Bowman's argument is not accepted by the district court and by the court of appeals. The Supreme Court of the United States granted *certiorari* and there was a feeling that the appellate decision might be overturned in favor of the farmer. But an unanimous court ruled once again in favor of Monsanto.

Since at least 1992, U.S. courts have supported the practice of Monsanto to tie a sale and a license and to introduce post-sale restrictions to farmers when purchasing patented seeds. In one case, judges justified such practices with the need to protect public health and to limit exposure to products liability. The same rationale has been applied by the U.S. Court of Appeals for the Federal Circuit to all self-reproducing biotechnological innovations.[25] *Bowman* does not come as a surprise, nor the judges' sentence that applying the first sale doctrine to the derivatives (generations) of self-reproducing technologies «would eviscerate the rights of the patent holder».

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[24]Because genetically-modified seeds are resistant to glysophate, while natural seeds are not, Monsanto's agents can easily verify whether one field is planted with natural or modified seeds. Spraying herbicides will kill the natural plants and weeds and will keep alive genetically modified varieties. If the farmer cannot show the bag where the seeds were stored, he is clearly an infringer. Monsanto has been also criticized for the forceful manners of its agents in collecting evidence, sometimes trespassing farmers' property. Monsanto's practices are also described by Johns (2009, p. 16). Enforcement techniques can produce false positives in case of the so called blown-by seeds, that is, situations in which genetically modified varieties are found in fields where seeds had not been used intentionally by farmers, but brought by the wind from adjacent fields.

[25]U.S. courts introduced the distinction between conditioned and not conditioned sales; exhaustion only applies to the latter and not in all cases in which the seller has put conditions in the terms of the agreement, which is exactly the case with seed-wrap licenses.

The U.S. Supreme Court had requested an opinion to the Solicitor General before issuing the decision in *Bowman* and this circumstance had been interpreted as if the Court would be ready to reverse the Court of Appeals' opinion and introduce a principle that applies the exhaustion principle also for self-replicating technologies.[26] But it was not the case. An unanimous Court reinforced the position that «[t]he exhaustion doctrine is limited to the "particular item" sold to avoid just such a mismatch between invention and reward». The first sale of the seed does not terminate the rights of the holder: «"a second creation" of the patented item "call[s] the monopoly, conferred by the patent grant, into play for a second time"».[27] The problem, one could just add, is in the fact that the monopoly could be called into play for the entire life of the patent and no matter how many generations of seeds are grown.

Importantly, the Court was clear to say that the power to prevent the use of second generation seeds stems directly from the kind of patent protection that attaches to biotechnological inventions and it is not dependent on contract terms. Hence, such terms are perfectly valid, as they are not aimed at unlawfully extending the exclusive rights granted by the patent.

4.1 Life After *Bowman* and European Union Law

Bowman is an interesting case, for a number of reasons. First of all, it reached the Supreme Court and it won a nine-zero opinion that is a strong signal about the practice of Monsanto and seed owners, thus setting a precedent that might have an influence even outside the jurisdiction of the United States.[28] Secondly, it endorses a different treatment for biotechnological innovations concerning self-reproducing technologies, that in fact are never subject to exhaustion, thus becoming stronger and more pervasive than any other innovation, but also raising the issue of consistency between intellectual property policy and other values (such as the promotion of biodiversity). Thirdly, it shows how, in the U.S. legal system, the sources of law interact on this very topic, where contract law remains essentially state law, whereas patent protection is federal law; enforcement of contracts for circulation of intellectual property rights is somehow influenced, at state level, by federal laws and this has also been considered as an area of potential friction at the interface of state and federal regulation. The U.S. case provides a good benchmark for

[26]According to Duffy (2010), the request of an opinion is an element that typically predicts the decision to grant *certiorari* to reverse the case. Empirical data on the relationship between requests of opinion and decisions are available in Thompson and Wachtell (2009).

[27]The Court of Appeals had been more cautious and justice Kagan affirmed that the decision did not aim to apply to all instances of «self-replicating products», although «such inventions are becoming even more prevalent, complex, and diverse»; see *Monsanto Co. v. Bowman*, 657 F.3d 1341 (Fed. Cir. 2011).

[28]Importantly, national solutions about exhaustion are extremely important because international sources, such as the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), refuse to deal with this topic and leave it up to states sovereignty.

European regulation, where the creation of an internal market by EU legislation has been jeopardized in many occasions by contractual practices that were deemed to be enforceable under state laws.

On the territories of the European Union the situation, at legal level, shows some differences, at least as far as genetically modified seeds are concerned. There might be political and economic reasons that justify the European view of the problem; after all, the main agro-bio companies are U.S. multinationals and the European industry, with few remarkable exceptions, lags behind. But it might well be that a casual legal difference provides the basis for a strategy of legal differentiation at regional level, that might compensate the negative externalities produced, at international level, by a more relaxed treatment of contracts for the circulation of intellectual property rights on genetically modified seeds.

The principle of exhaustion, created initially by case law, has been instrumental in supporting the process of market integration in Europe, by limiting the power of intellectual property owners and the ability for them to control the circulation of goods downstream once a merchandise has been put in commerce on the European territory.[29] It has been then incorporated into patent laws (and intellectual property laws in general).

Since 1988, in *Erauw-Jacquery*, the European Court of Justice acknowledged that some restrictions in license agreements were necessary (and thus exempted by antitrust laws) in order to protect the investment of companies, since «the development of the basic lines may involve considerable financial commitment».[30] The Court joined the argument of advocate general Mischo, that some contractual restrictions are required «to control the destination and the use of the basic seed; otherwise [the owner] would risk the de facto loss of the exclusive rights granted to him in respect of the new varieties which he has developed».[31]

The issue of exhaustion for patent rights on biotechnological inventions is now dealt with under EC Directive 98/44 (art. 10) and the solution is not devoid of difficulties, entangled as it is into general statements and specific exceptions. More in details, art. 11 of the Directive states, by way of exception to the general principle of protection, that the sale or other forms of commercialization of plant propagating material [*scil.*: seeds] to a farmer, by the holder of the patent or with his consent, for agricultural use implies authorization for the farmer to use the product of his harvest for propagation or multiplication by him on his own farm, the extent and conditions of this derogation corresponding to those under Article 14 of EC Regulation 2100/94 (see, *infra*, next paragraph). In light of the mandatory nature of

[29]For a discussion of the current dimension of exhaustion in European Union law, see Schovsbo, *The Exhaustion of Rights and Common Principles of European Intellectual Property Law*, in Ohly (edited by), *Common Principles of European Intellectual Property Law*, Tübingen, 2012, 169.

[30]ECJ 19 April 1988, C-27/87, *SPRL Louis Erauw-Jacquery c. La Hesbignonne SC*, in *ECR*, 1988, 1919.

[31]Opinion of Advocate General Mischo of 9 December 1987, *SPRL Louis Erauw-Jacquery c. La Hesbignonne SC,* par. 11 (in *ECR*, 1988, 1919).

Article 11, single-use licenses in Europe are not enforceable if they aim to take away from farmers the freedom granted by the Directive.

The relevant side of the provision, for what matters with respect to the purpose of this paper, is that the exhaustion only applies to the extent seeds are used (also for replanting) for internal purposes and not to put them in trade. Exchange of seeds is not allowed because that practice would imply a use that is by the farmer but not on his own farm. The ability to multiply the seeds for internal purposes has a positive impact on farming, to the extent it allows the farmer to deal with genetically modified seeds and with their derivatives without necessarily being forced to purchase seeds every season. Moreover, the farmer can mix his own seeds with those purchased or with second generation seeds and promote, a least internally, biodiversity.[32]

4.2 Concurring Forms of Protection: Utility Patents and Plant Variety Registration (UPOV)

At an international level, a relevant source for intellectual property protection of plant varieties is the International Convention for the Protection of New Varieties of Plants (UPOV convention). The convention has been introduced also in the European Union with EC Regulation 2100/94 on Community Plant Variety Rights. Importantly, as stated in art. 1 of the Regulation, its provisions are the sole and exclusive form of protection for plant varieties in Europe.[33]

Plant varieties can be reproduced by natural techniques (for instance, by mere cutting) and such circumstance is again a source of vulnerability for protection. The extent to which exhaustion limits protection for breeders is defined in art. 16 of the UPOV convention. The breeder's right shall not extend to acts concerning any material of the protected variety, or of a variety covered by the provisions of art.14 (5) (concerning varieties which are essentially derived from the protected variety), which has been sold or otherwise marketed by the breeder or with his consent in the territory of one Contracting Party concerned, or any material derived from the said material, unless such acts (i) involve further propagation of the variety in question or (ii) involve an export of material of the variety, which enables the propagation of the variety, into a country which does not protect varieties of the plant genus or species to which the variety belongs, except where the exported material is for final consumption purposes.

[32]The interpretation of the Directive followed by the European Court of Justice is consistent with the purpose to maintain a difficult equilibrium for all the interests involved in this matter. For instance, in *Monsanto v. Cefetra*, the ECJ stated that art. 9 of the Directive define a level of harmonization that does not allow national Member States to increase the level of protection; see ECJ July 6, 2010, C-428/08.

[33]The protection for plant varieties is also available in the U.S. with the Plant Varieties Protection Act (PVPA). The relationship between utility patents and plant varieties patents has been discussed in *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc.* 534 U.S. 124 (2001). The case is discussed by Daniels (2003), Rives (2001), Nilles (2000).

Many Contracting States, including the European Union (as signatory party of the Convention) within Regulation 2100/94, have adopted the solution that allows to restrict the breeder's right in relation to any variety in order to permit farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting, on their own holdings, the protected variety or a variety that is essentially derived by the one protected. Regulation 2100/94 limits this possibility to the varieties listed in art. 14.2.

Also in these sources there has been an attempt to reconcile a policy of incentives with the need not to excessively restrict farmer's freedom, at least with respect to activities that can be considered "private" and that are presumptively of limited impact on the market.[34]

There appears to be a divide between the U.S. law on agro-bio inventions and the extent of patent protection, on the one side, and the European solution, coupled with the international sources, on the other side. The U.S. system adopts a position of absolute protection for innovators in biotechnological agriculture and accepts unconditionally all the implications, including the use of contracts (and unilaterally imposed terms) to further limit farmers' freedom, if such freedom can pose a threat to the exclusive rights of right holders or weakens his business model. Moreover, the lack of exhaustion effects in case of self-reproducing matter is considered a built-in feature of intellectual property protection. An uncompromising faith into the incentives' structure of patent laws seems to justify the policy.

On the other side, the European Union and many other countries, even if aware of the difficulties in striking the right balance, are more in favor of a limited freedom of farmers, by allowing exhaustion in circumstances where private use can be reasonably accepted.

5 International Laws and the Interface Between Intellectual Property Policy and Contract: The Nagoya Protocol

The topic of genetically modified seeds cuts across other relevant aspects concerning the international regime of trade in those fields where seeds are at the beginning of the value chain. The values at play are not necessarily only those of the biotech industry or of farmers. As it should be clear, to the extent biodiversity is essential to ecosystems, the need to preserve non-genetically modified varieties (while not discouraging biotechnological researches) is also extremely important for the public at large. Moreover, outside most developed nations there is a kind of agriculture that is inspired by communitarian values and that mixes elements of cultural, economic, sometimes religious dimension.[35]

[34]To some extent, the grower can limit the ability of farmers to do certain things by contractual restrictions, but without relying on property rights. Acts contrary to the restrictions only qualify as breach of contracts, not as infringement.

[35]See Ferran (2014).

When the destruction of biodiversity if feared as a possible consequence of an indiscriminate use of stronger and more resistant varieties, all those values come to play altogether and finding a balance point can be near to impossible. Preserving biodiversity implies also a responsible use of the intellectual property rights at national level and an enforcement of contracts that does not extend unreasonably the powers conferred upon rights holders by intellectual property regimes. Differences in legal systems, in this respect, are not necessarily a negative thing, as it will be clarified in the next paragraphs.

Biodiversity can be at risk not only as a consequence of the introduction and massive use of genetically modified varieties, but also by unauthorized access to natural resources of communities where the environment is still rich and pristine, compared to more industrialized and intensively cultivated territories. Such access has often turned into biopiracy and to practices that have been identified as "predation" or neo-colonialism, in line with the warlike terminology mentioned at the beginning.

In a sense, it sounds as a vivid paradox the fact that even the most advanced research of developed countries needs access to local and poorly codified knowledge generated at community level in less developed countries by a slow and steady accumulation that lasted for centuries, if not for a 1000 years.[36] The impact of such access is sometimes dreadful, because resources are appropriated, modified, subjected to intellectual property rights and then sold as new products to local farmers, for whom such resources used to be free. Biodiversity is compromised, a regime of commons is destroyed, resources become exclusive and other communitarian values are overridden.

In order to preserve biodiversity and combat biopiracy, member states which are part of the Convention on Biodiversity eventually introduced a specific international instrument, that is the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity.[37] The purpose of the Protocol is to make sure that genetic resources are accessed under consent of the communities they belong to and that utilization of genetic resources allows a fair and equitable share of benefits to such communities.[38]

The European Union has signed the Protocol on June 23, 2011 and has approved it on May 16, 2014 with a specific regulation. In October 2012, the European Commission presented a proposal for an EU Access and Benefit Sharing

[36]One often quoted example of biopiracy is the case for the "devil's claw" (*Harpagophytum procumbens*), an herb native of the eastern and southern Africa that local communities of the San people used as an anti-inflammatory and now widely employed in the pharmaceutical industry.

[37]The Protocol was adopted on October 29, 2010. See Tania Bubela, E. Richard Gold, *Genetic Resources and Traditional Knowledge. Case studies and Conflicting Interests*, EE, 2013. Catherine Rodhes, *Governance of Genetic Resources*, EE, 2013. Charles Lawson, *Regulating Genetic Resources*, EE, 2012.

[38]Levidow and Carr (1997), reported that unpaid royalties to less developed countries amount to 5.4 billion USD.

(ABS) Regulation to implement the mandatory elements of the Nagoya Protocol for the European Union. The European Parliament and the Council adopted the new EU Regulation (No 511/2014) on 16 April 2014. It has entered into force on 9 June 2014. Entry into force of Regulation 511/2014 was made dependent on the entry into force of the Protocol, which happened at its fiftieth ratification.[39]

The main provisions of the regulation (art. 4, 5 and 7), concerning obligations in the use and transfer of genetic resources will only become applicable one year after the entry into force of the Nagoya Protocol. Regulation 511/2014 implements the mandatory parts of the Protocol (basically a repetition of its main provisions), whereas a further implementing regulation is currently being worked out, although it is not yet clear when this is going to be adopted.[40]

One of the pillars in the policy of the Protocol is about due diligence efforts that each private party has to exercise when receiving a genetic material, to make sure the relevant provisions of the Protocol have been complied with.[41] As a consequence, a significant role for the functioning of the Protocol is expected by Member States of the EU, which will have the role of cooperating with the Commission to lower, as much as possible, the due diligence costs associated with access to genetic resources and traditional knowledge.[42]

Since seeds are genetic materials, under the terms of the Protocol, the use of seeds and the genetic manipulation of plant varieties will be now subject to the provisions of the Protocol. Hopefully, exotic varieties will not be appropriated and modified without the consent of the local communities and phenomena of reverse technology transfer will be avoided.[43] Nothing in the Protocol prevents individuals

[39]As of the date of this writing (February 2015), the Protocol has been ratified by 59 States, out of the 196 Parties of the CBD.

[40]There might be coordination problems in implementing the Protocol in Europe that might eventually jeopardize its effectiveness. The European Union is one of the signatories of the agreement, together with European Members States. Since several measures will depend on states, there is the genuine risk that institutional activisms of the European Union will collide with prerogative of Member States in implementing the instrument.

[41]Importantly, the protocol also refers to, and protect, the traditional knowledge associated with genetic resources (see art. 7 of the Nagoya Protocol). Traditional knowledge is for genetic resources what complementary know-how is for a patented technology. It resides in indigenous and local communities and is part of their tradition.

[42]Due diligence is the pillar of the Protocol as far as circulation of genetic resources is concerned. In each transaction, each party belonging to an implementing state will be subject to the duty to ascertain whether the resource has been lawfully acquired (that is, in compliance with the principle of access). In the past, it was suggested that one solution to ease the identification of the origin of resources was force applicants to declare the source of the material in the patent application. The solution had been opposed, as burdensome, by the International Seed Federation (*Disclosure of Origin in Intellectual Property Protection Applications*, Bangalore, 2003). Very likely it will be considered again as a possible way to mitigate the duty of due diligence.

[43]Reverse technology transfer is the situation in which a state is supposed to pay to access resources that are subject to proprietary rights of a third party, although such resources were originally from the recipient state.

and companies to resort to intellectual property protection for genetic resources that have been appropriated, if the owner of the resource consented to access.

Furthermore, the legal relevance of the Protocol for genetically modified seeds lies in the fact that genetic resources (including traditional know how) are subject to the mechanism of consent and to an international property rights regime. There is nothing inherently against intellectual property in the Protocol and nothing conclusive about the superiority of legal solutions to find an equilibrium about values at play. To the extent consensus is required, there is an implicit acknowledgement that those resources are proprietary resources and cannot be freely appropriated or modified or exchanged. The Protocol aims at fighting biopiracy with the same legal weapons that are conventionally used in Western countries: property and contracts. The alternative option, one based on an international liability rule, would have been better than the *status quo*, but less respectful of sovereignty of less developed states.[44]

On a less positive note, unfortunately the Protocol is an international instrument, whose application at national level depends on voluntary implementation by states and although the level of acceptance is high, it should be underscored that the most enthusiastic acceptance comes obviously from less developed countries. As it holds for the CBD, one of the most important states in the world is not part of the Protocol, that is, the United States. Thus, a very large portion of the world (one of the most industrialized countries and the homeland of the most powerful agro-bio industries) does not recognize and apply the principles of the Protocol, thus introducing a wound to the underlying policy and escaping the international regime of liability for access to genetic resources.[45] The fact the U.S. are not part of the Protocol is a big weakness to the overall international legal framework, because as a matter of fact the main players of the genetically modified seed market are U.S. multinational corporations. The Protocol here might prove less effective, but if corporations are no longer generally free to appropriate genetic resources in biodiverse environments, it is a first bulwark against plunder that nevertheless will impact on individual conducts and business models. The Protocol is undeniably part of the legal framework in which the issue of genetically modified seeds must be deal with.

[44]The *status quo* is represented by a situation in which seed grabbing is actually practiced as in an era of colonialism land grabbing was justified by a doctrine of *terra nullius*. The Protocol recognizes sovereignty over national resources and rebuts the principle of free appropriability of common resources. A solution that is close to liability rule was adopted by a number of national legislations in the U.S., where farmers are allowed to use second generation seeds for sowing, by compensating the rights holders, as reported by Leaven, *The Misinterpretation of the Patent*, cit., 140.

[45]Since 1996, the U.S. territory is the land that is cultivated more than others with genetically modified varieties, followed by Argentina, Canada, Brazil, China and South Africa.

6 Negative Externalities

Differences in the legal framework that states create to govern the behavior of players working on the value chain of seeds generate inevitable international externalities. One remarkable example is represented by the U.S. position towards the Nagoya Protocol. The option not to regulate the access to third parties' genetic resources provides an advantage to the national industry, but projects costs on less developed countries and on other states that joined the Protocol. Overall, the international trade is affected and the purposes of the Protocol might be frustrated or strongly limited. The effectiveness of international legal instruments is inevitably dependent on the widest acceptance.

Adopting a paradigm of regulatory competition on the very topic of agricultural biotechnology can lead to the conclusion that, in order to attract the biotech industry, state regulation should be more friendly for businesses, even if this choice would harm farmers by increasing the costs to access seeds or by limiting their ability to save and exchange seeds. At international level, the Nagoya protocol is a set of mandatory rules that aims at limiting biopiracy and discouraging the kind of race to the bottom that an unregulated competition among legal systems would trigger. But the application of the protocol is ultimately made dependent on the will of those same players that might take advantage from unregulated competition. Furthermore, excessive regulation through mandatory rules can discourage innovation and the transfer of technology and the Nagoya protocol is a delicate exercise to keep a balance among the values at play.

A strategy of supporting the biotech business vis-à-vis the farmers with the creation of a favorable legal environment (one that allows freedom of contract to the maximum extent and that interprets intellectual property laws as univocally aimed at protecting the right holder) has also negative effects at national level.

Concentration on the supply side is almost inevitable. Because of the capital intensive investments required in the agro-bio industry, there is a natural trend towards concentration and oligopoly, which is a further element of complexity to find an international legal equilibrium. As a matter of fact, the whole agro-bio industry is in the hands of few high-tech, large and organized multinational corporations, which can also exert lobbying power over decision-makers and can easily cope with dispersed and less organized forces.[46]

The extent to which other branches of the legal system can control such powers is unclear. A lenient treatment of contract practices for circulation of proprietary technology clearly goes in the direction of reinforcing the position of the industry. Beyond contract law and intellectual property, competition rules at national level could only be applied in case of restrains on trade or abuses of dominant position (attempt to monopolize the market, in the U.S.), but actions are unlikely. But since

[46]As reported by Center for Food Safety & Save Our Seeds, *Seed Giants vs. Farmers*, cit., 12, three companies (Monsanto, DuPont, and Syngenta) now control 53 % of the global market for seeds, while the top ten companies have a joint market share of 73 % (and many of them are U.S. corporations).

an international regime of antitrust enforcement is missing, the effectiveness of antitrust policy in this respect is doubtful.

It has been also argued that favoring the agro-bio industry and its products (like genetically modified seeds) has effect on the demand side as well. High yield seeds increase productivity, but the higher productivity comes at the cost of margins reduction. Survival then becomes possible only for larger farmers with significant portions of land and financial resources that can rely on large volumes of production. The result is concentration also on the demand side, with the consequence that smaller farmers are marginalized and doomed to disappear. And since biodiversity is strictly dependent on communities of smaller farmers, eventually the risk of dominant varieties becomes actual.

There is evidence of this trend in *Bowman*. One argument raised by the farmer is relevant. Bowman stated that the second sowing is necessary for running its business, but it is riskier (than the first one) and access to less expensive seeds should justify its practice. Bowman's position resembles pretty much like that of many other small farmers worldwide that try to escape or relax the harshness of Monsanto TSA. The argument is not a valid defense against the accusation of patent infringement and provides no excuse from breach of contracts. But it reveals how farmers are exposed to the costs to access seeds and with lower profitability only the large ones have the chance to survive, as long as they concentrate on specialized monoculture, to make sure economies of scale ensure a satisfactory return on their investments.

Last but not least, the intellectual property policy as a means to create incentives for the biotech industry can feed opportunistic behaviors by large corporations with internal research and development capabilities. Systems of *ex post* rewards leave absolute freedom to individuals to pursue their own research agenda. This is one of the undisputable virtues of intellectual property rights, vis-à-vis other more centralized forms of incentives. At the same time, the directions of research could favor varieties that are more resistant to pesticides than to pests, and intellectual property protection would be available for both.[47] The choice about what should be commercialized could be inspired by different motivations and interests. If a corporation is active in sales for pesticides, it is not necessarily motivated to introduce on the markets pest-resistant varieties. It would be too simplistic (and practically unfeasible) to conclude that the way to favor one direction and disfavor the other is to allow protection only in the former case and not in the latter. Intellectual property systems do not discriminate in this regard and it would be a very coarse policy to throw the baby out with the bathwater.

With respect to this latter case, the answer is not necessarily in the intellectual property policy. Many agro-bio products (including seeds) can be subject to regulations and controls and states do have other options to provide signals to the

[47]One often quoted side effect in terms of moral hazard of the massive resort to genetically modified varieties is the increase in the consumption of pesticides/herbicides, which is not necessarily an unwanted consequence from the perspective of the producer of such substances.

industry in terms of what can be more easily commercialized.[48] Incentives to research and development can be left untouched, but more fine-grained regulation downstream can to some extent control opportunistic behavior and make sure that commercial choices are consistent with the public interest and not just with the goal of having short-term financial returns.

But apart from monitoring the market from the easier perspective of regulating products, other problems remain and it should be kept in mind that intellectual property protection on genetically modified seeds has implications that go way beyond the individual rewards for innovative products.

7 Regulation by Technology

The option to dismiss altogether the intellectual property policy in this field would be ineffective, if not ruinous, not just for the potential destruction of individual incentives, but because one alternative for the industry would be to replace exclusive rights with more uncompromising technological solutions.[49]

Of course, in a world of no intellectual property, the industry could raise prices to compensate the loss of business that freedom to reproduce seeds would cause.[50] This strategy would be tantamount to granting absolute protection in terms of discrimination, as only large farming facilities could afford higher prices to access selected seeds. However, the most baleful outcome would be choice to use technology to protect the genetically modified seeds.

Such possibility is open to the industry thanks to so called Genetic Use Restrictions Techniques (GURTs), also referred to as "terminator" technology or "suicide seeds", that is to say genetic modifications that regulate the expression of genes in plants, causing second generation seeds to become sterile.[51] Such technological solutions would remove the self-reproducing traits of genetically modified seeds that justify a different treatment of exhaustions effect. If second generation seeds are sterile, "copies" are technically impossible and downstream control, whether by contract techniques or by property prerogatives, does not make sense.

[48]Many legal systems, including the European Union, have regulated the downstream activities that are required for a genetically modified product to reach the market. Regulation here serves the additional purpose of controlling the impact of the technology on human health and the environment, without discouraging research and development.

[49]Yet, it is an option that someone would pursue firmly; see for instance Boldrin and Levine, *Against intellectual monopoly*, cit., 243 («[P]rogressively but effectively abolishing intellectual property protection is the only socially responsible thing to do»).

[50]See Kesan, *Licensing Restrictions*, cit., 1086, with a further discussion of the complexity of the value chain in the agro-industry.

[51]GURTs are typically split into two categories: those that restrict the use at variety level (V-GURTs) and those that restrict at trait level (T-GURTs). One remarkable case of GURT is one jointly developed by the Delta and Pine Land Company in cooperation with the U.S. Department of Agriculture (USDA). See International Seed Federation, *Genetic Use Restriction Technologies*, Bangalore, 2003 (position paper describing V-GURT development).

GURTs are for genetically modified plant varieties what digital rights management systems (DRMs) are for technological copyright on digital goods; nothing else than a technical response to the threat posed by imitation and reproduction to intangible resources. With one remarkable difference. While legal solutions have national validity and can be enforced at national level, technological solutions, like GURTs and DRMs, do not need enforcement by national authorities and do not suffer from sovereignty limitations. While this feature can be seen as an undisputable advantage, technological self-help comes to the cost of a complete removal of any freedom, including fair uses that legislation might, by time to time, consider in order to balance concurring interests. Technology, in this respect, is much less modular and uncompromising. Above all, technological solutions remove any chance of a regulatory competition and do not favor the emergence of alternative solutions that states can occasionally enact. The mechanics of technological solutions would be even more drastic in terms of consequences.

The topic of GURTs is not the only instance in which the regulatory role of technology is discussed, but the essence of the issue is the same. GURTs imply concentration of power in the hands of technology owners and escape the comprehensive systems of control and limits that are typical of legal regulation in terms of territorial dimension, democratic participation to lawmaking, enforceability before controllable institutions as courts.

There is an ongoing debate about the use of GURTs in the agro-bio industry, and the discussions are not only legal; there are aspects of bio-security and food security that must be dealt with accurately. Moreover, it has to be investigated the impact of GURTs use on biodiversity. If genetically modified seeds are deactivated after the first sowing, the variety has less chance to become dominant. On the other side, the potential decrease of costs of seeds—caused by the reduced vulnerability to copying—could turn into lower prices and easier access for farmers to genetically modified seeds that would eventually become dominant.

Whether regulation by technology is superior to state regulation is open to discussion. For sure, it is not devoid of risks and side effects. Quite paradoxically, regulation by technology can be in need of state laws, as it happens for technological protection measures in copyright. At the other extreme, state regulation could outlaw the use of GURTs, and the relationship between the two techniques of social control could be conflictual.

8 An Alternative Paradigm

The several implications of intellectual property protection applied to genetically modified seeds, and the alternatives available, are evidence of the complexity of a problem, that is the ability of regulation at any level to strike an acceptable balance between innovation, farmers' and communities' rights, the demand to preserve biodiversity and the objective need to limit international negative externalities related to state strategies to attract foreign direct investments or to protect the

national industry at the expenses of other countries (and of the international community at large).

In the field of genetically modified seeds, resort to intellectual property protection is deemed to be cause of multiple side effects, that eat into biodiversity, market concentration and the promotion and protection of other (communitarian) values. In the complexities of regulation, and taking into account all its limitation, one significant support comes from the Nagoya protocol. To the extent plunder of genetic resources (and local varieties among them) is barred, or made more difficult by an international instrument, each country has now more effective means to preserve its genetic diversity and its identity. This is a first small step and there might be technical difficulties in making it work properly, but it is a crucial contribution.

Before a paradigm of regulatory competition, there is sometimes the impression that the race to the bottom is inevitable and independent by states' will.[52] But it is not. At least, lowering the level of protection of non-economic values is not the only available approach if policy makers at state level are willing to pursue alternative models of growth. Diversity in regulation can be instrumental in favoring, at least initially, a strategy of differentiation with respect to other countries without necessarily refusing an intellectual property policy.

Intellectual property rights seem to be supportive of one model of extremely centralized and concentrated agriculture, with low margins for big farmers, based on genetically modified resources, intensive exploitation of large portions of land with monocultures and propagation of market power in other markets (it is not a secret that the largest rights holders on genetically modified seeds also produce herbicides and pesticides). That model is probably responsible for providing resources in bulks, for a fast-growing world, wherever plants can be used for food, energy or raw materials productions. But if a given country does not see fit with that model, other solutions are available.

There can be an alternative model, based on high-quality productions of bio-diverse local varieties (still somehow protected against imitations and, thus, subject to intellectual property rights), cultivated with traditional methods at a very decentralized level by farmers and communities of farmers. The two systems can compete but competition has to be fair and regulation (both at state and international level) is mandated to ensure a level playing field for the two models.

If promoting alternative models of exploitation is the goal, then legal solutions should be consistent. For instance, the answer adopted by the European Directive 98/44 with respect to exhaustion and farmers rights is somehow responsive to the need for farmers to have some limited internal use of second generation seeds. There is an equilibrium in there, but is different from that found by the U.S. courts

[52]States have different options to pursue a strategy of attracting foreign investors. Magic (2003, p. 6), stated that «attracting FDI—and consequently technology transfer—solely by means of strengthening IPR is not a good long term economic strategy for a developing country because it will not do nothing to build a domestic industry of high-tech R&D».

in *Bowman* and it is not said that it is a bad one. After all, the agro-bio industry does business also in Europe.

The case of intellectual property rights on genetically modified seeds is one remarkable example of the direct connection between strategies of growth and regulation, when multiple interests are at play. The seed war is way too often fought in a dismissive way, as a war in favor *or* against intellectual property protection. This attitude might result destructive of incentives for states to experiment background legal conditions for alternative models of agriculture that rely on a more reasonable use of intellectual property rights and a more equitable sharing of resources. The Nagoya Protocol aims at fighting biopiracy by reinstating principles of sovereignty, property and consent. Those same principles are common to intellectual property policy. As the agro-bio industry is able to combine property rights and contractual techniques to serve their purposes, there might be alternative combinations to support an agriculture that is grounded on different values and is more respectful of local communities.

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Open Bioinformation in the Life Sciences as a Gatekeeper for Innovation and Development

Roberto Caso and Rossana Ducato

Abstract

Despite the increasing advocacy towards the "openness" of science and research data, it is still far from being a widespread practice. The goal of this paper is to identify the most pressing obstacles (in terms of funding, technology, Intellectual Property Rights, contracts, data protection, and social norms) which are hindering the development of Open Science and Open Research Data, with particular attention to the situation of developing countries. The innovative aim of this paper, which is the first essay of a broader research, is to prepare the epistemological basis for a Law and Technology theory of "Open Bioinformation" (OB), where bioinformation stands for research data in life sciences. We argue that so far the literature has addressed the promotion of openness in science and research data only in a sectorial manner, taking into account just one or a few of the factors affecting openness as if they were not related or mutually influenced. Therefore, the suggested solutions are limited to a single perspective and fail to consider the dynamics of information control. In our view, a holistic approach, that tries to zoom out from the specific disciplines and take into account the whole picture, would contribute to determining an effective policy for promoting OB. For this reason, we have to consider the technological, legal,

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and sociological aspects, in order to assess whether and how changes in one domain might affect the others.

1 Introduction

Everyone says that data sharing is an imperative in science. Everyone agrees that the free and immediate access to genetic information and medical data is crucial for the progress of life sciences research. Paraphrasing James Boyle in one of his most famous writings, such statements are so obvious that we should be able to make them in a law article without having to add footnotes.[1]

Open access (OA) to research data, as a gatekeeper for innovation and development, is of paramount importance in the so-called "Global South" (GS). In the field of medical and biotechnological research, developing countries face a considerable delay, which is exacerbated by the chronic lack of funds for the creation of research infrastructures and investment in education and training, as well as by widespread recourse to the practice of secrecy and/or the application of strong Intellectual Property Rights (IPRs), which hinders access to and circulation of scientific knowledge.[2]

A possible way out of this situation has been identified in the open models for sharing the building block of life sciences, i.e. research data. In particular, in the paper we refer to such a heterogeneous category as "bioinformation" in order to subsume a composite set of digitized biological information, relating to an individual, and which is commonly used for the purposes of biomedical and biotechnological research.[3] The following section will be specifically dedicated to framing the definition of bioinformation and explaining the importance of sharing for current scientific research. The third section will be devoted to understanding the dynamics, the content, and the tools of "openness" in life sciences. Open models for the free access and reuse of scientific knowledge are commonly catalogued under the labels of "Open Science" (OS) and "Open Research Data" (ORD), but their meaning is still vague and polysemantic in the literature. For this reason, we will try to untangle some ambiguities, by clarifying the terms of our discourse and presenting the legal transposition of OS and ORD.

[1]The reference is to Boyle (1997, p. 87).

[2]Stiglitz (2008) and Henry and Stiglitz (2010), who argue that poorly designed intellectual property regimes can impede innovation. According to them, there are alternative ways of organizing research—i.e. providing funding and incentives—that can help promote innovation and disseminate its results in a more efficient manner. See also the reflections in Nelson (2004).

[3]The term "bioinformation" has not yet been used in the meaning that is proposed here. An analysis of the literature shows it in three occurrences. In a first sense, it is used in bioinformatics to describe biological information in living organisms (see Paton 1996; Kangueane2009); in a second sense, it is used in forensics to allude to DNA and fingerprints (Nuffield Council of Bioethics 2007); finally, in a third and generic sense, it is mentioned as a synonym of gene/genome (Milosavljevic 2000; Parry (2004)) or as information about the human body, Rose (2001).

Our analysis grew out of the realisation that despite the increasing advocacy towards the "openness" of science and research data, it is still far from being a widespread practice.[4] The goal of this paper is to identify the most pressing obstacles (in terms of funding, technology, IPRs, contracts, data protection, and social norms), which are blocking the development of OS and, in particular of ORD, with particular attention to the situation of developing countries.[5] The innovative aim of this paper, which is the first essay of a broader research, is to prepare the epistemological basis for a Law and Technology theory of "Open Bioinformation" (OB), where bioinformation stands for research data in life sciences. We argue that so far the literature has addressed the promotion of openness in science and research data only in a sectorial manner, taking into account just one or a few of the factors affecting openness as if they were not related or mutually influenced. Therefore, the suggested solutions are limited to a single perspective and fail to consider the dynamics of information control. In our view, a holistic approach, that tries to zoom out from the specific disciplines and take into account the whole picture, would contribute to determining an effective policy for promoting OB. For this reason, we have to consider the technological, legal, and sociological aspects, in order to assess whether and how changes in one domain might affect the others.

Once the causes of the problem have been identified, we will recommend some strategies and solutions that could make OB a more viable option. In particular, we will discuss two examples ("open through licenses" and "open through social norms") where openness can be realized thanks to the combination of different strategies and legal tools.

2 There's Something About Bioinformation: A Short Premise on Research Data for Life Sciences

If information is the blood and fuel of our world, indeed bioinformation is the vital principle of the current research methods in life sciences.[6] "Bioinformation" is an umbrella term we use to refer to information that is: (a) *bio*logical, i.e. of cellular and molecular human origin; (b) related to the *βίος*, the existential sphere of a person's life; (c) *bio*informatic, since computer programming is applied to the processing of biological data, which are digitized or born-digital; (d) *bioMedTech*, in the sense that it can be used for the purpose of medical or biotech research. This includes all information derived from biological samples or consisting of data generated by the individual or other subjects involved in the care/research process (physicians, researchers, nurseries, etc.). This can be, *inter alia*, data relating to the molecular or biochemical characteristics of the sample, genetic information, data generated in clinical trials, diagnosis, prescriptions, medical history, eating habits, etc.

[4]David and Foray (2002) and Pampel and Dallmeier-Tiessen (2014).

[5]From a comparative perspective, we must specify that no particular geographic area will be the object of the analysis: we will mention some general trends shared by the countries of the GS.

[6]Quoting James Gleick: "*We can see now that information is what our world runs on: the blood and the fuel, the vital principle*" (Gleick 2011).

The availability of this data is not only crucial for personalized medicine, but also a fundamental resource in many fields of bioscience research, since by linking genomic data or biochemical interactions with environmental factors and information relating to the illness' long-term course, we can improve our understanding of the causes or development of certain diseases (it is the idea currently behind research methods, for example, in genome-wide association studies, drug discovery, cancer research, translational medicine, pharmacogenomic investigations, etc.).[7]

Advances in technology and the convergence of different disciplines—computer science, biology, engineering, mathematics, and medicine—have helped to shape this kind of information as a new commodity[8]: nowadays, genome sequencing is faster and cheaper than at the end of the Human Genome Project[9]; data are more accurately annotated and can be stored in more widely available high-quality tools —such as computers, smartphones, and wireless devices; infrastructures like the new generation of research biobanks linked to electronic health records allow for professional and systematized collection[10]; the huge amount of data generated can be gathered in new kinds of storage spaces like the cloud[11]; data and information can be easily copied and transferred through digitization,[12] and so on.

Technology has greatly contributed to the potential of scientific progress, developing tools and infrastructures that allow for more and better information. Nevertheless, data collected by a researcher or a single institution, even a large one, are not sufficient to conduct a genome-wide association study or an evidence-based medicine project[13]: firstly, because data-intensive scientific discovery needs a huge amount of information from diverse sources; secondly, such investigations are intrinsically interdisciplinary, thus requiring collaboration from experts from different disciplines; thirdly, the skills, equipment and know-how are shared among stakeholders in both the public and private sector, making it necessary to overcome the traditional boundaries between the different players and build new forms of partnerships.[14]

Thus, progress in research requires a vast pool of scientifically reliable data, as well as expertise from different fields of knowledge and industry. Such a need has made data sharing, rather than an option, a categorical imperative for promoting

[7]West (2006).

[8]On the commodification of information caused by the expansion of the IPRs domain and the new possibilities opened up by technology, see Boyle (2003) and Hess and Ostrom (2003). With a specific focus on developing countries, Forero-Pineda (2006).

[9]The Human Genome Project (http://www.genome.gov/10001772) was a collaborative research program started in 1990 and aimed at sequencing the entire human genome. The first draft was published in 2001 (International Human Genome Sequencing Consortium: Lander et al. 2001), while the complete sequence was released in April 2003. At the end of the Human Genome Project the cost of the sequencing was around $100 million and in 2014 was estimated at $5,000. See Hayden (2014).

[10]Kohane (2011), Jensen et al. (2012), Scott et al. (2012) and Guarda (2013).

[11]Rosenthal et al. (2010) and Stein (2010).

[12]Topol (2013).

[13]Floca (2014, p. 298).

[14]In drug discovery, the collaboration among industries, academia, and other funders has been supported by Weigelt (2009). See also, Krumholz et al. (2014).

scientific progress (in the public interest) and, at the same time, for surviving in a highly specialized and competitive market (in the interest of private companies).[15] This is confirmed by the creation of networks of international research consortia that adopt collaborative policies and open access rules. The latter were codified in some soft law instruments, such as the Bermuda Principles (1996),[16] the Fort Lauderdale Agreement (2003),[17] the Amsterdam Principles,[18] or the Toronto Statement.[19] Many other initiatives from governments, international organizations and civil society have been supporting OA to scientific data over the last few years. To mention a few of them: the OECD *Principles and Guidelines for Access to Research Data from Public Funding* (2007)[20]; the EU Commission Communication on *Scientific information in the digital age: access, dissemination and preservation* (2007)[21]; the Panton Principles (2010)[22]; the Royal Society *Science as an open enterprise report* (2012)[23]; the UNESCO *Policy guidelines for the development and promotion of open access* (2012)[24]; the EU Commission Communication *Towards better access to scientific information: Boosting the benefits of public investments in research* (2012)[25]; the EU Commission Recommendation *on access to and preservation of scientific information* (2012)[26]; the *Open Research Data Pilot* in Horizon 2020.[27]

Despite the spread of an "open culture" and the common understanding of the need for data sharing in science, there is still confusion around terms like "Open Science" and "Open Research Data". Actually, they are not clearly defined from a legal perspective. The next section aims at providing a coherent legal framework for such concepts.

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[15]Hagedoorn et al. (2000) and Edwards et al. (2009).

[16]http://web.ornl.gov/sci/techresources/Human_Genome/research/bermuda.shtml. Accessed 18.10.2014.

[17]http://www.genome.gov/Pages/Research/WellcomeReport0303.pdf. Accessed 18.10.2014.

[18]Rodriguez et al. (2009).

[19]Toronto International Data Release Workshop Authors (2009).

[20]http://www.oecd.org/sti/sci-tech/38500813.pdf. Accessed 18.10.2014.

[21]COM(2007)56, http://ec.europa.eu/research/science-society/document_library/pdf_06/communication-022007_en.pdf. Accessed 18.10.2014.

[22]Murray-Rust et al. (2010).

[23]https://royalsociety.org/~/media/policy/projects/sape/2012-06-20-saoe.pdf.

[24]http://unesdoc.unesco.org/images/0021/002158/215863e.pdf. Accessed 18.10.2014.

[25]COM(2012) 401, http://ec.europa.eu/research/science-society/document_library/pdf_06/era-communication-towards-better-access-to-scientific-information_en.pdf. Accessed 18.10.2014.

[26]C(2012) 4890 final https://ec.europa.eu/research/science-society/document_library/pdf_06/recommendation-access-and-preservation-scientific-information_en.pdf. Accessed 18.10.2014.

[27]The pilot was announced in 2013, http://europa.eu/rapid/press-release_IP-13-1257_en.htm. Accessed 18.10.2014; see Article 43 of the Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020—the Framework Programme for Research and Innovation (2014–2020)" and repealing Regulation (EC) No 1906/2006; see also the Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020, version 1.0, 11 December 2013, http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf. Accessed 18.10.2014.

3 "Open Science" and "Open Research Data": Finding the Definitions

Open science is a very popular concept in the current scientific debate, but its meaning seems to be defined and interpreted in different nuances.[28] An oft-cited definition comes from Stephen Maurer, who described the OS features around three pillars: "(a) full, frank, and timely publication of results, (b) absence of intellectual property restrictions, and (c) radically increased pre- and post-publication transparency of data, activities, and deliberations within research groups".[29] More broadly, OS has been described as: "not only accessibility to research objects such as articles, data, code, protocols and workflows that people are free to use, re-use and distribute without legal, technological or social restrictions, but also the opening up of the entire research process—right from agenda—setting, data generation and data analysis, to dissemination and use".[30]

For an overview of the OS phenomenon, it is useful to refer to the study by Fecher and Friesike, who from a literature review have identified at least five "schools of thought"[31]: (1) the so-called "Public School" emphasizes the need to make science understandable for the general public and the research process accessible to scientists; (2) the "Democratic School" stresses the importance of gaining access to the products of research (not only publications and data, but namely source materials, digital representations, multimedia materials); (3) the "Pragmatic School" promotes OS as a mechanism for making research more efficient; (4) the "Infrastructure School" deals with the challenges raised by the technical infrastructures that enable collaborative research projects through the web; (5) the "Measurement School" argues in favour of alternative and specific scientific impact factors for the digital age.

To adopt a strict notion of OS would be useless by definition, also considering the "open" nature of such a concept. Rather than five parallel lines, we imagine the different schools outlined by Fecher and Friesike as diverse points of view on the same phenomenon, showing us various ways of approaching it. They necessarily complement each other. The argument behind "openness" finds its root in the idea of Mertonian communalism,[32] but OS can alternatively be justified in light of utilitarian theories (it is better because it is more efficient). The promotion of sharing and collaboration among researchers shall be enabled through suitable online (and common) platforms and infrastructures. At the same time, such a system of sharing and dissemination of results can only withstand if scientists are given the right incentives. An open and wide diffusion of science materials is not only beneficial to professionals, but has to engage society more generally,

[28]Grubb and Easterbrook (2011) and Frischmann et al. (2014).

[29]Maurer (2003). In the same sense, Nielsen (2011).

[30]Open Knowledge Foundation (2014, p. 15).

[31]Fecher and Friesike (2014).

[32]Merton (1942).

empowering citizens. Sharing shall not be confined to scientific publications or materials, but extend to research data. The latter, in particular, are the object of the "Open Research Data" movement, a subcategory of the broader OS. Research data, such as those previously outlined as bioinformation, "form[s] the basis for the quantitative analysis underpinning many scientific publications",[33] and they represent the fundamental building block of basic research.[34]

OS and ORD have certainly emerged as extra-legal phenomena, but they have begun to take on a legal dimension. Therefore, it is crucial to understand how they fit in the legal categories and what sources of law can be found in this field.

We can find some general normative indicators in the mandate to share scientific knowledge and benefits derived from them, affirmed by Article 27 of the Universal Declaration of Human Rights (1949), Article 15 of the Covenant on Economic, Social and Cultural Rights (1966), Articles 2 and 19 of the UNESCO Declaration on the Human Genome and Human Rights (1997), and Articles 2, 15, and 24 of the UNESCO Universal Declaration on Bioethics and Human Rights (2005), which explicitly take into consideration the importance of scientific data sharing for developing countries[35]; meanwhile, the relevance of a broad access to biological materials and genetic data has been affirmed by Articles 18 and 19 of the UNESCO International Declaration on Human Genetic Data (2003).

Despite the principles they affirm, these international documents only have a programmatic value. Their provisions are declamations and not binding and operative rules. Furthermore, they are not decisive for our discussion because they do not solve the main critical tension, that is the balance between free access to the benefits flowing from scientific knowledge and the exclusive rights granted by intellectual property law: to use the terms of the UNESCO Declaration on the Human Genome and Human Rights, such soft law statements echo, but do not

[33]European Commission (2012), point 3.

[34]The definition of research data is hard to find in the literature. According to some authors, because there is no consensus on the notion of data itself, it would be preferable to adopt a very broad approach: the term *research data* shall "include any kind of data produced in the course of scientific research, such as databases of raw data, tables, graphics, pictures or whatever else". Dietrich and Wiebe (2013, p. 17). In the same sense, also the EU Guidelines on *Open Access to Scientific Publications and Research Data in Horizon 2020* which state that: "*Research data* refers to information, in particular facts or numbers, collected to be examined and considered and as a basis for reasoning, discussion, or calculation. In a research context, examples of data include statistics, results of experiments, measurements, observations resulting from fieldwork, survey results, interview recordings and images" (footnote 5, p. 3). See also Leonelli (2013b), according to whom: "scientific data can be defined as material artifacts that are collected and used as empirical evidence for the plausibility of claims about the nature of reality ('the earth revolves around the sun') and/or the efficacy of specific interventions ('500 milligrams of paracetamol help to relieve headache')".

[35]Caulfield et al. (2012).

prejudice, the international instruments governing the IPRs framework.[36] The conflict with TRIPs Agreements was pointed out in the Report on Ethics, Intellectual Property and Genomics, issued by the International Bioethics Committee (IBC) in 2002.[37] It is interesting to note that this document explicitly mentions the term "open science"—understood in a narrow sense as the antithesis to a strong intellectual property rights protection on some pharmaceutical developments which is able to affect the right to life and health of millions of people, especially in the South of the World—but we should also note that the concerns expressed in it were not implemented in the subsequent UNESCO declarations.

The top-down approach does not solve our problem of finding the legal definitions. In fact, we should note that *openness* started to become familiar in the legal discourse from the bottom, and, in particular, with the advent of open source software and, later on, the open access movement.[38]

Open source software, born in the computer programming environment, is characterized by a decentralized production and a collaborative effort among everyone who wants to contribute to the programming of a piece of software.[39] Openness here concerns the source code of the software (i.e. the human-readable language), which is freely distributed. In this way, the program can be: run for any purpose; studied and modified as desired; redistributed as such; distributed with the modifications.[40] In order to keep the code open, a *viral* license is applied, which allows software to be freely used, modified, and shared, but both the code and any enhancement or derivative work must be shared on the same license terms.[41]

Open Access refers to research publications and its core has been recognized (and shaped) by the "Three Bs", three declarations issued between 2002 and 2003, and resulting from three different initiatives: the Budapest Open Access Initiative Declaration (2002), the Bethesda Statement on Open Access Publishing (2003), and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003). Its main features have been effectively summarized by Peter Suber, who has described OA as a literature that is "digital, online, free of charge,

[36]Namely, the Berne Convention for the Protection of Literary and Artistic Works of 9 September 1886 and the UNESCO Universal Copyright Convention of 6 September 1952, as last revised at Paris on 24 July 1971, the Paris Convention for the Protection of Industrial Property of 20 March 1883, as last revised at Stockholm on 14 July 1967, the Budapest Treaty of the WIPO on International Recognition of the Deposit of Micro-organisms for the Purposes of Patent Procedures of 28 April 1977, and the Trade Related Aspects of Intellectual Property Rights Agreement (TRIPs) annexed to the Agreement establishing the World Trade Organization, which entered into force on 1 January 1995.

[37]http://unesdoc.unesco.org/images/0013/001306/130646e.pdf. Accessed 18.10.2014. See Kuppuswamy (2009, p. 137 and ff).

[38]Caso and Ducato (2014).

[39]See Di Bona and Ockman (1999), Raymond Raymond (2000) and Stallman (2002).

[40]These are the four fundamental freedoms established by the General Public License manifesto: https://www.gnu.org/gnu/manifesto.en.html. Accessed 18.10.2014.

[41]Probably the best known example is the GNU GPL license, created by Richard Stallman. Stallman (1998).

and free of most copyright and licensing restrictions".[42] OA philosophy, thus, recognizes an unrestricted access and reuse of e-contents through the Internet, and contractual tools as the operative solution for doing so. In this sense, the Creative Commons licenses, developed since 2002, have been a valuable instrument for supporting the implementation of OA in a concrete way.[43] Through these modular and user-friendly licenses, the way of sharing digital content—not necessarily creative (it is possible for example to waive the *sui generis* right on databases)—has been radically changed, because the author is free to choose their copyright settings.[44]

Filtering the precipitate of both open source and open access in order to infer a legal meaning of the concept of *openness*, we can observe at least two aspects in which the law can operate: firstly, openness involves a limitation of IPRs; secondly, accessibility to a specific resource is managed through licenses or contracts.

The foregoing observations hopefully clarify the terms of our analysis. We can now proceed to analyse the dynamics of ORD in its operational reality, paying particular attention to the situation of developing countries.

4 Open Bioinformation in the Developing World: An Overview

If ORD is crucial for the promotion of innovation and development in technologically advanced countries, it is even more so for the developing world, where openness is now considered a possible way for lifting the traditional barriers between the North and the South of the globe.[45]

In the public health field, the promotion of access to scientific information as a means for overcoming the inadequate institutional, infrastructural and regulatory capacity to conduct high-quality investigations in Africa has been strongly affirmed by the Algiers Declaration on "Narrowing the Knowledge Gap to Improve Africa's Health" (2008).[46]

Besides the declamations, some projects based in the developing world are starting to promote collaborative science and ORD/OB in a concrete way: it is the case of the Human Heredity and Health in Africa (H3Africa) Consortium,[47] which aims at building a network for engaging African countries in the genomic

[42]Suber (2012). For a complete overview of the OA movement, see Frosio (2014); meanwhile for a specific focus on academic publications, Moscon (2015).

[43]https://creativecommons.org/. Accessed 18.10.2014.

[44]Lessig (1999), Carroll (2006) and Goss (2007).

[45]Rahman (2012, p. 7).

[46]The Algiers Declaration was issued by the ministers of health and heads of delegation of African countries, during the Ministerial Conference on Research for Health in the African Region, held in June 2008.

[47]Ramsay et al. (2014).

revolution; the MalariaGEN,[48] a data-sharing community studying malaria by integrating epidemiology with genomics; the Gambian National DNA Bank,[49] the first biobank created in Africa in collaboration with the Jean Dausset Foundation-CEPH that promotes the sharing of collected information; the Malaysian Oral Cancer Database and Tissue Bank System (MOCDTBS),[50] which makes data and specimens available to researchers; or the *Datos Científicos Abiertos* Program,[51] launched by the *Comisión Nacional de Investigación Científica y Tecnológica* (CONICYT) of Chile for promoting best practices and the creation of a policy for sharing scientific data.[52] Several initiatives are coming up from the bottom. A paradigmatic example is the OpenSciDev Group, attributable to the Open Knowledge Foundation, whose goal is to set the agenda for the realization of an open and collaborative science in the developing world.[53]

OS, ORD and OB in particular, are becoming extremely popular because they can potentially solve some age-old problems of the GS, *in primis* the availability and the equal distribution of information and knowledge. As pointed out by the OpenSciDev Group with reference to publications, academic and commercial journals are inaccessible to most of the researchers and institutions in developing countries due to the high cost of subscription.[54] Such a situation creates a vicious circle, because limited access to research resources reduces the chances of authors from the GS of being published in international journals, and their underrepresentation implies at least two important consequences:[55] (1) a limited visibility and a low impact factor of developing-country (DC) researchers (and, as a result, they have little chance of spreading their ideas, being quoted, being involved in collaborative research projects, having access to opportunities for training abroad, etc.); (2) a reduced ability for institutions both of the North and the South to know the research generated in a certain DC, thus preventing both North-South and South-South collaborations.

The same applies to scientific data produced in life sciences research. Those fields are highly expensive, requiring a huge amount of investment for the gathering of samples, data and analysis: the cost of laboratories, chemicals, reagents,

[48]http://www.malariagen.net/. Accessed 18.10.2014. For an overview of their data-release policy, see Parker et al. (2009). MalariaGEN is a network that includes several participants from different countries, thus enacting a North-South collaboration.

[49]Sirugo et al. (2004).

[50]Zain et al. (2013).

[51]http://datoscientificos.cl/. Accessed 18.10.2014.

[52]Muñoz Palma (2012).

[53]http://openscidev.com/. Accessed 18.10.2014. One of the most interesting things is the *modus operandi* adopted by such a group, which which shares all its documents online via googledocs. So, everyone who wants to contribute to the project and working papers can suggest some edits and comment on the files. All documents are licensed under CC-BY 4.0.

[54]Open Knowledge Foundation (2014, p. 17 and ff). See also Chan et al. (2005) and Dulle et al. (2013).

[55]Chan et al. (2005), Czerniewicz and Goodier (2014) and Veldsman and Gevers (2014).

machinery, equipment, specialised and trained personnel is unaffordable for most DCs.[56] To give an overview of the costs, we can mention the well-known example of the Human Genome Project.[57] The US government invested about $2.7 billion from 1990 to 2003 in the collaborative research program aimed at the sequencing of the entire human genome. Just to have an idea of the scale, the cost of a single research project is approximately equivalent to the GDP of Burundi in 2013.[58]

Almost all research in DCs is conducted with scant public funding and the partnership with industry is not well implemented, so the sharing of bioinformation is of paramount importance for carrying out data-intensive research in those DCs that would otherwise be cut off from the research net.[59] An open approach, supported by a decent ICT infrastructure and sufficient expertise, could offer a cost-effective solution for performing research with limited resources.[60]

OB can also foster participation and engagement in a research project.[61] This is of particular importance in life sciences research, where the success of an investigation may depend on the collaboration, in some cases, of a group of people or an entire population. A democratization of the whole process, the so-called "partnership governance",[62] incorporating research participants and giving them decision-making power, would allow citizen empowerment and increase trust in the organization conducting the research.[63]

Thus, strong altruistic and economic arguments support the promotion of OB, but there is a further point to consider, which has ethical implications. A great number of DCs represent a sort of new 'goldmine' for biotechnologically advanced countries. Populations from low-income countries can be the source of a valuable pool of data, because of the genetic peculiarities of a certain ethnic group or, sadly,

[56]Hardy et al. (2008).

[57]http://www.genome.gov/10001772. Accessed 18.10.2014.

[58]According to the data of the World Bank. See http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?order=wbapi_data_value_2013+wbapi_data_value+wbapi_data_value-last&sort=asc. Accessed 18.10.2014.

[59]Hardy et al. (2008), Gómez and Bongiovani (2012), Muñoz Palma (2012, p. 24) and Rahman (2012, p. 15).

[60]Open Knowledge Foundation (2014, p. 20).

[61]Ibid., p. 22; Tindana et al. (2007).

[62]Winickoff (2009). The model for realizing such a partnership governance could be found in the charitable trust, according to Winickoff and Winickoff (2003).

[63]According to Frischmann, Madison, and Strandburg: "commons governance offers a defense against potential privatization of commonly useful shared resources and the possibility that an individual IP rights owner would "hold up" the enterprise as a whole. Examples of such arrangements might include "open source" commons constructed for basic biological building blocks such as the Single Nucleotide Polymorphism (SNP) consortium or the publicly available databases of genomic sequences that are part of the Human Genome Project. Formal licenses and related agreements assure that participants become part of what amounts to a mutual nonaggression pact that is necessary precisely because of the possibility that intellectual resources may be propertized" (Frischmann et al. 2014, p. 26).

because patients affected by the diseases are based there.[64] After the collection of biological samples and information, research is conducted in developed countries and the results (new drugs, treatments, diagnostic methods, vaccines, etc.) are not always granted back to research participants, thus raising several ethical and benefit-sharing concerns.[65] It would be fair and compliant with the international principles mentioned above to make freely available at least the data and the analysis generated from the screening of DCs' population, allowing local scientists to reuse them for the needs and priorities of local research.[66]

Even though OB represents a new hope for the GS, it is not a common practice and it is facing several obstacles. From a literature review, we have counted six variables that affect the openness of data, and, in particular, bioinformation: (1) public investment; (2) technology; (3) intellectual property; (4) contracts; (5) privacy; (6) social norms.

(1) The origin of every problem related to OA can be traced back to funding and sustainable business plans for the long term.[67] In the GS, basic research is carried out with an insufficient amount of public money.[68] As already outlined, the lack of public-private partnerships does not help overcome such an impasse. This can result in inadequate lab equipment, resources, and libraries, the lack of educational and training programs for specialised personnel, a weak ICT infrastructure, etc.[69]

(2) OB may be hampered by technology: the lack of ICT infrastructures or their inability to share and re-use information, hindering the database interoperability or data portability, constitutes a serious weak point in the very possibility of data sharing.[70] The process of integrating data depends on the adoption of standards which ensure the source (metadata) and the data curation.[71] In the GS the problem is exacerbated by poor digitization of information and limited access to the Internet.[72]

[64]Sgaier et al. (2007).

[65]Costello and Zumla (2000), Cambon-Thomsen (2004), Dickenson (2004), Knoppers (2005) and Parker et al. (2009). For an overview of the main critical issues of such a practice, see also de Vries et al. (2011).

[66]Knoppers (2000).

[67]Bastow and Leonelli (2010). The study by Halla Thorsteinsdóttir, Uyen Quach, Abdallah S. Daar and Peter A. Singer shows that political will and public investments have been crucial for the development of health biotechnology in seven developing countries (Brazil, China, Cuba, Egypt, India, South Africa, and South Korea), which have been taken into account as case studies (Thorsteinsdóttir et al. 2004).

[68]Muñoz Palma (2012), Mboera (2012) and Inyang (2012).

[69]Sirugo et al. (2004), Hardy et al. (2008), Mboera (2012) and Rahman (2012, p. 8).

[70]De Roure et al. (2003), Altunay et al. (2010) and Leonelli (2013a).

[71]Ankeny and Leonelli (2015).

[72]Kahn (2012), Mboera (2012), Leonelli (2013b) and Open Knowledge Foundation (2014, p. 37).

(3) The complex landscape of intellectual property rights and the uncertain legal status of data are a serious disincentive to collaborative research.[73] The commodification and enclosure of data may appear in the guise of copyright and *sui generis* database right protection. Such IPRs, although designed for databases, ultimately end up affecting the contents of the database itself.[74] In particular, the *sui generis* right has been strongly criticized for its potentially negative consequences, such as the danger of creating monopolies, the increase of transactions costs, the interference with data aggregation, and the negative impact on the cooperative ethos.[75]

(4) The private control of bioinformation is indeed exercised through contracts, as in the case of Data Transfer Agreements (DTA). These can be effectively enforced through technological measures that are designed to manage and protect the rights of access and use of digital contents, including through the immediate and timely sanction of any violation of the contract conditions.[76] Mastering the jungle of the terms of agreements is far from a trivial task, and it inevitably involves transactional costs,[77] which are incompatible with the timelines of scientific research.[78]

(5) The rationale of OB is potentially in conflict with the right to privacy and confidentiality.[79] Just to mention the two biggest legal models for data protection, in Europe, Directive 95/46/EC[80] and Directive 2002/58/EC[81] frame the general rules, which will be profoundly affected by the new Regulation, with particular reference to the treatment of personal data for scientific research[82]; meanwhile, the US has sector-specific federal legislation (the HIPAA; the Federal Drug and Alcohol Confidentiality Statute; the Common

[73]Guibault and Wiebe (2013). See also, Reichmann and Uhlir (2003).

[74]Trosow (2004) and Davison and Hugenholtz (2005).

[75]Reichman and Samuelson (1997), Reichman and Uhlir (1999), David (2000), Reichman and Uhlir (2003, pp. 396 and ff.), David (2004) and Trosow (2004).

[76]Dussollier (2002), Caso (2004) and Ginsburg (2005).

[77]Guibault and Margoni (2013).

[78]Reichman and Uhlir (2003, pp. 402–404), Streitz and Bennett (2003) and Margoni (2013).

[79]Kaye (2012), Hoffman (2014) and Mascalzoni et al. (2014).

[80]Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, published in the Official Journal L 281, 23.11.1995, pp. 0031–0050.

[81]Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications), published in the Official Journal L 201, 31.07.2002, pp. 0037–0047.

[82]See, in particular, Article 83 of the Draft of the General Data Protection Regulation [COM(2012) 11 final, 25.01.2012]. The text of the proposal is available at the following link: http://ec.europa.eu/justice/data-protection/document/review2012/com_2012_11_en.pdf. Accessed 18.10.2014.

Rule; the GINA Act, etc.).[83] The basic principle in both jurisdictions is the obtainment of the data subject's informed consent. Such rules, designed to protect a fundamental right, pose de facto (legitimate) restrictions and exemptions to OB.[84]

Another fundamental point stressed in the literature is that such protection only comes into play if information relates to an identified or identifiable person (*ex multis*, Article 2, Directive 95/46/EC; Article 5, § LXXII, Brazilian Constitution; Article 2, *Ley de Argentina* 25326/2000; Article 4(d), *Ley de Uruguay* 18331/2008; Article 3(b), *Ley de Costa Rica* 8968/2011; Chap. 1, § 55, South Africa Act 4/2013), or protected health information (PHI) that "does not identify an individual" or allow "a reasonable basis to believe that the information can be used to identify an individual" (HIPAA). Such an objective scope is critical because it is failing on that technological premise on which all data protection legislations have relied for reaching a balance between the protection of the individual and the free movement of information: anonymization.[85] Several studies show the increasing possibility of re-identifying individuals from anonymized data,[86] suggesting that anonymization is a promise that cannot be maintained in absolute terms in the digital environment.[87]

(6) Finally, it is fundamental to take into consideration social norms, and, in this case, the scientific ethos. Despite the Mertonian principles,[88] researchers are not ontologically inclined to share their data for a number of reasons[89]: creating a dataset costs time, money and labour and they are not willing to share it without some form of compensation; sharing would eliminate the competitive advantage; the quality of a dataset might determine how grants are awarded, with consequent benefits in terms of career advancement and livelihood of the research group.[90] The lack of adequate economic or reputational incentives risks inhibiting the informal exchange of information within the scientific community. In the GS, such a problem seems to be one of the most difficult to address, since several scholars denounce the practice of secrecy as a common behaviour in the community of peers and the lack of a culture of sharing.[91]

[83]Health Insurance Portability and Accountability Act [(45 C.F.R. § 160–164 (2002)]; Federal Drug and Alcohol Confidentiality Statute (42 U.S.C. § 290dd-2); the Common Rule [45 C.F.R. § 46.101 (2005)]; Genetic Information Nondiscrimination Act (42 U.S.C. § 2000ff et seq.).

[84]Schwartz (1994), Solove (2004) and Floca (2014).

[85]Ohm (2010).

[86]Gymrek et al. (2013).

[87]Lunshof et al. (2008).

[88]Merton (1942).

[89]Borgman (2007).

[90]Gitter (2013).

[91]Mboera (2012) and Rahman (2012, p. 8).

All these factors should be considered in order to design an effective policy for OB, because they mutually influence each other. In order to provide a preliminary analysis of these complex dynamics, we will examine two cases in which we can observe the interactions among some of the abovementioned variables for achieving openness of bioinformation: the first one touches upon the limitation of IPRs through licenses and social norms, while the second one focuses on how to shape the social norms of the scientific community by using incentives and legal tools.

5 IPRs in Data?

In order to solve the first set of issues, a premise is needed: we have to understand which type of IPRs can be applied to data. In contrast to secret information or the end-product (publications or inventions), the application of an exclusive right in factual data is highly problematic. There is no legal definition of data nor a specific regulation for them.[92] The word "data" (*datum*, in Latin) comes from the ancient Greek *dedomena*, that literally means "difference". According to a general notion, they are uninterpreted variables not processed by a cognitive intervention.[93] If there is no human intervention, strictly speaking, the necessary precondition for intellectual or industrial property is missing.[94]

Nevertheless, IPRs can indirectly affect data management and circulation through the legal regime applicable to the collections of data. Compilations and databases, in fact, can be protected by copyright and, in some jurisdictions, also by the so-called *sui generis* right (SGR).[95] Collections of data are eligible for copyright protection if they constitute, as a whole, an original work of authorship, whose creativity is expressed through the selection, coordination or arrangement of data and materials.[96]

[92]The only one legally described and expressly regulated is personal data, which is protected in accordance with national and international data protection rules.

[93]Floridi (2010, pp. 25–28).

[94]As is well known, copyright protects original works of authorship, but not facts or ideas; meanwhile, patent law grants the temporary monopoly for an invention that is new, involves an inventive step and is susceptible of industrial application. A right of property in data can be detected also in the provisions regarding the protection of a certain type of information, as in the case of know-how (see Article 39 TRIPS).

[95]For a general overview, see Derclaye (2014).

[96]Such a principle is valid on both sides of the Atlantic. The US system, in fact, protects compilations "as a work formed by the collection and assembling of pre-existing materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship" (17 U.S.C. § 101); meanwhile, Directive 96/9/EC on the legal protection of databases states that "databases which, by reason of the selection or arrangement of their contents, constitute the author's own intellectual creation shall be protected as such by copyright. No other criteria shall be applied to determine their eligibility for that protection" (Article 3). The case law has confirmed the legislative component in the leading case *Feist v. Rural*, 499 U.S. 340 (1991) for the US system and in the ECJ Case C 5/08 *Infopaq*

In some jurisdictions, non-creative databases can also be protected[97]: this is the case of the *sui generis* right recognized in the EU and Mexico, and the sweat of the brow doctrine accepted in South Africa.[98]

The EU legal system grants a 15-year protection period of protection to "the maker of a database which shows that there has been qualitatively and/or quantitatively a substantial investment in either the obtaining, verification or presentation of the contents to prevent extraction and/or re-utilization of the whole or of a substantial part, evaluated qualitatively and/or quantitatively, of the contents of that database" (Article 7, Directive 96/9/EC).

The substantial investment, and not creativity, is the precondition for the exercise of the SGR; furthermore, the work of the maker of the database must be directed to the gathering, validation or presentation of data. The interpretation of such requisites has given rise to some contrasts. In particular, the meaning of obtaining and verification has been at the centre of a hermeneutical dispute before the European Court of Justice (ECJ). In *British Horseracing Board v. William Hill*

(Footnote 96 continued)
International [2009] ECR I 6569 and Case C-604/10 *Football Dataco Ltd and Others v Yahoo! UK Ltd and Others* [2012] ECDR 7 for the EU.

[97]For historical accuracy, we have to mention that before the introduction of Directive 96/9/EC, a similar right, namely the "catalogue rule", already existed in Scandinavian countries (Karnell 1997). Also the US and the Australian systems used to protect the non-creative databases, applying the sweat of the brow doctrine, according to which copyright rewards the efforts and work that go into a compilation of facts. Such a principle was rejected in the US since the notorious case Feist v. Rural (1991), where the Court affirmed: "Without a doubt, the 'sweat of the brow' doctrine flouted basic copyright principles. Throughout history, copyright law has 'recognized a greater need to disseminate factual works than works of fiction or fantasy'. *Harper & Row*, 471 U.S., at 563. […] But 'sweat of the brow' courts took a contrary view; they handed out proprietary interests in facts and declared that authors are absolutely precluded from saving time and effort by relying upon the facts contained in prior works. In truth, 'it is just such wasted effort that the proscription against the copyright of ideas and facts… [is] designed to prevent' […] Protection for the fruits of such research… may in certain circumstances be available under a theory of unfair competition. But to accord copyright protection on this basis alone distorts basic copyright principles in that it creates a monopoly in public domain materials without the necessary justification of protecting and encouraging the creation of 'writings' by authors". For a comment, see Fulwood (1991), Ginsburg (1992) and Strong (1994). For the sake of completeness, it should be noted that after the enactment of Directive 96/9/EC, the US Congress tried to re-insert an exclusive right model for database protection similar to the SGR with some legislative proposals in 1996 and 2000. See Reichman and Uhlir (2003).The Australian jurisprudence arrives at the same conclusion in the cases I*ceTV Pty Ltd. v. Nine Network, Australia Pty Ltd.* (2009) and *Telstra Corporation Limited v Phone Directories Company* (2010) (Lindsay 2012).

[98]For a general overview of the *sui generis* right in Europe, see Stamatoudi (1997) and Derclaye (2008), (2014). An introduction to the Mexican provisions regarding the legal protection of databases can be found in Ovilla Bueno (1998), Caballero Leal (2000) and De La Parra Trujillo (2004).

Organization Ltd (2004)[99] and the three *Fixtures* cases (2004),[100] the European Court distinguished between "obtaining" and "creation": the database is eligible for the *sui generis* protection only if the aim of the investment is to "seek out existing independent materials and collect them",[101] but not if the effort is directed at the "resources used for the creation as such of independent materials".[102] The activity of verification implies the ensuring of the reliability of the information contained in a database. Thus, according to the ECJ, the substantial investment has to be evaluated only with regard to those resources used "to monitor the accuracy of the materials collected when the database was created and during its operation"[103] and not those "used for verification during the stage of creation of data or other materials which are subsequently collected in a database",[104] because they are resources used during a database creation.[105] In other words, the ECJ tried to "domesticate"[106] the SGC recalling the utilitarian rationale of the directive, that is the protection of data storage and the encouragement of processing system development and not the creation of new informational resources like data and materials.[107]

The exclusive right attributed to the maker of the database is particularly pervasive because it helps prevent a lawful user of the database from extracting and/or re-utilizing substantial parts of its contents, evaluated qualitatively and/or quantitatively, and impede the repeated and systematic extraction and/or re-utilization of insubstantial parts of the contents of the database if in conflict with a normal exploitation of that database or with the legitimate interests of the maker of the database (see, in particular Articles 7 and 8, Directive 96/9/EC).

The directive contains a temperament for the abovementioned control by the maker of the database, allowing Member States to implement specific exceptions to SGR, such as in the case of extraction for the purposes of illustration for teaching or

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[99]ECJ Case C-203/02, *British Horseracing Board v. William Hill Organization Ltd* (BHB) [2004], ECR I-10415.

[100]ECJ Case C-338/02, *Fixtures Marketing Ltd v. Svenksa AB* (Svenska), [2004] ECR I-10497; ECJ Case C-444/02, *Fixtures Marketing Ltd v. Organismos Prognostikon Agonon Podosfairou EG* (OPAP), [2004], ECR I-105449; ECJ Case C-46/02, *Fixtures Marketing Ltd v. Oy Veikkaus Ab* (Oy Veikkaus), [2004] ECR I-10365.

[101]*British Horseracing Board v. William Hill*, para 31.

[102]Ibidem.

[103]Ibid, para 34.

[104]Ibidem.

[105]Although the ECJ seems to make a clear distinction, in several cases it can be very hard to find a difference between the obtaining and creation of scientific data. The terms of the debate can be efficiently summarized by referring to the two points of view expressed by Derclaye (2004) and Davison and Hugenholtz (2005).

[106]Davison and Hugenholtz (2005).

[107]As the Court motivates, in fact: "the purpose of the protection by the *sui generis* right provided for by the directive is to promote the establishment of storage and processing systems for existing information and not the creation of materials capable of being collected subsequently in a database". *British Horseracing Board v. William Hill*, para 34.

scientific research, as long as the source is indicated and to the extent justified by the non-commercial purpose to be achieved (Article 9, Directive 96/9/EC). This (shiny) attempt at openness has not been transposed across the whole Union in a uniform way, remaining a dead letter in many legal systems like Italy and Spain.[108]

Furthermore, we have to consider the duration of the SGR: it arises automatically from the date of completion of the database but the period of protection begins to run afresh after any substantial change, evaluated qualitatively or quantitatively, to the contents of a database, including any substantial change resulting from the accumulation of successive additions, deletions or alterations, which would result in the database being considered to be a substantial new investment, evaluated qualitatively or quantitatively. In that case, the database resulting from that investment shall qualify for its own term of protection (Article 10, Directive 96/9/EC).

The vagueness of the European *sui generis* right and of its scope have raised several concerns from a legal point of view. The "rolling" duration, the difficulties in distinguishing in practice between "obtaining" and "creation" of data, the unclear policy about publicly funded databases,[109] and the limited scope of the SGR exceptions make such a right "one of the least balanced and most potentially anti-competitive intellectual property rights ever created".[110]

Similar policy considerations can be made with reference to the Mexican SGR, although we should point out that such a legal model has shortcomings and has been poorly developed. Article 108 of the *Ley Federal del Derecho de Autor* (1996) only states that: "Las bases de datos que no sean originales quedan, sin embargo, protegidas en su uso exclusivo por quien las haya elaborado, durante un lapso de 5 años". Interpreting in a systematic way such a provision, we can infer that all non-creative databases, regardless of any evaluation of the effort for establishing them, are protected by the Mexican SGR for a period of 5 years. Furthermore, in contrast to the European solution, the SGC cannot be cumulated with copyright: original database are covered by the *derecho de autor*, meanwhile non-original databases can be protected through the SGR.[111] Even though the duration is shorter than the European SGR, the objective requirements are broader and the SGR extends to all non-creative Mexican databases, without taking into account any further conditions.

[108]Ducato (2013) and Guibault and Wiebe (2013).

[109]Only The Netherlands has explicitly denied a public authority the ability of exercising the SGR (Article 8, Dutch Database Act). See, Guibault (2013). Although not expressly recognized by the legislative component, also in the Italian legal system it is possible to reach the same conclusion. Legal scholars have, in fact, observed an irresolvable contradiction between the industrial or commercial rationale protected by the Directive and the public goals pursued by a public administration, rejecting the application of the SGR to publicly funded databases. See, Cardarelli (2002). The same principle has been confirmed also by the case law and precisely by Tribunale di Roma, Sez. IP, ordinanza 5 giugno 2008, Edizioni Cierre s.r.l. v. Poste Italiane s.p.a., in AIDA, 2010, 688.

[110]Reichman and Samuelson (1997).

[111]See De La Parra Trujillo (2004).

In South Africa the sweat of the brow doctrine is still a cornerstone of copyright protection.[112] Contrary to the holding of the *Feist* case, the South African High Court has recently affirmed the copyright infringement in the case *Board of Healthcare Funders v. Discovery Health Medical Scheme and Others* (2012), since the latter used, published and adapted the contents of applicants' Practice Code Numbering System ("PCNS"). The PCNS is a database that includes personal data related to medical practitioners (name, address, bank account details, preferred payment methods, etc.) and codes for medical service providers, attributing to such information a unique identifying number. In stating the violation of the Copyright Act, the South African Court interpreted the originality requirement adopting a very low standard: "There is little doubt if regard be had to the work and energy put in over the three phases of the development of the PCNS that indeed while some of the component parts may not necessarily be original in its totality the work could be said to be original. It would be cynical to suggest that no effort or skill was expended in the development of the system over the years and in my view the respondents' stance that the work lacks originality must be dismissed in the light of the meaning that has come to be attached to the concept of originality in the case law developed over the years".[113]

5.1 Open Through Licenses

The limits imposed by IPRs in scientific databases, through the long arm of the control offered by copyright and SGR, but also the uncertainty about the legal status of a dataset (as seen in the case of Europe, Mexico, and South Africa) may hinder both the regional and the transnational circulation of information. In these circumstances, a viable solution towards open models can be pursued through a legal agreement: "since the legal status of scientific databases and their content is more difficult to assess […], the use of standard licenses would eliminate the need for the user to look for the rights owner and to negotiate the terms of use".[114]

Several models of standard licenses, in the form of user-friendly web tools, have been developed over the last few years allowing the exercise of IPRs on digital content according to the needs and wishes of the author. Probably the most well-known example are the Creative Commons (CC) licenses.[115] Such legal

[112]Pistorius (2008).

[113]The Court here refers to Bosal Africa (Pty) Ltd v Grapnel (Pty) Ltd & Another 1985 4 SA 482 (C); Payen Components SA Ltd v Bovic CC and Others 1995 4 SA 441; CCH Canadian Ltd v Law Society of Upper Canada [2004] 1 SCR 339; Haupt t/a Soft Copy v Brewers Marketing Intelligence (Pty) Ltd and Others 2006 4 SA 458 (SCA).

[114]Guibault and Margoni (2013, p. 148). See also, Aliprandi (2011) and Leucci (2014).

[115]Creative Commons (CC) is a charitable corporation that promotes the sharing and circulation of knowledge in compliance with copyright law. Although it offers standardized models, its modular licenses (attribution, non-commercial, no derivative works, share alike) and their combinations can provide flexibility in setting the interests of the parties. http://creativecommons.org/.

instruments, created by the ingenuity of Lawrence Lessig, offer both professionals and laymen a simple way to manage copyright and, as far as we are concerned, also database rights. CC license are, in fact, designed in three main layers: (1) the Legal Code, that is the full text of the license; (2) the Common Deed, or the "human-readable" version that summarizes in an effective way (also through the use of icons) the main conditions of the license; (3) the "machine-readable" version of the license, which is written in a software format that computers can understand.[116]

There are essentially three types of CC license that can promote the principles of data openness in different nuances[117]:

- CC0 ("No Right Reserved").[118] Rather than a license, it is a waiver according to which the author dedicates the work to the public domain by giving up all of his or her rights to the work worldwide.[119] In our case, it means that, for example, everyone can copy, modify, or distribute a substantial part of a database, even for commercial purposes, without asking permission and before the expiration of the 15-year period.
- CC-BY-4.0 ("Attribution").[120] Solving a gap affecting the previous ones, the latest version (4.0) of this license applies also to data, since it expressly includes the copyright on database and the SGR.[121] Under the terms of this agreement, the licensor grants a worldwide, royalty-free, non-sublicensable, non-exclusive, irrevocable license to reproduce and share his/her creation, in whole or in part, and to produce, reproduce, and share any modification of the same. The only obligation of the user is to give credit to the creator in any reasonable manner requested by the licensor, provide a link to the license, and indicate if changes were made.[122] Another innovation of the version 4.0, attractive for researchers, relates to the attribution requirements: in addition to the obligation of indicating the URI (Uniform Resource Identifier), to the extent reasonably practicable, the new CC-BY includes also the possibility of indicating the hyperlink to the licensed material. In this way, credit attribution is flexible and allows an easier compliance especially in the case of datasets.[123]

[116] https://creativecommons.org/licenses/.

[117] Creative Commons provides two other options, namely "non-commercial" and "no-derivatives". See, Guibault (2013).

[118] http://creativecommons.org/about/cc0.

[119] Aliprandi (2011, p. 33).

[120] http://creativecommons.org/licenses/by/4.0/.

[121] Guibault (2013). For a critical analysis of the previous exclusion of the database SGR from the scope of the CC licenses, see Guibault (2011).

[122] http://creativecommons.org/licenses/by/4.0/legalcode.

[123] On the other hand, such a possibility carries on the problem of the links' expiration, which de facto is able to cross the attribution obligation. For a general overview of the problem for digital publication, see Kling and Callahan (2003).

- CC-BY-SA-4.0 ("Attribution-Share Alike").[124] In addition to the clauses already seen for the CC-BY, the Share-Alike adds to the license the so-called viral effect: every modification, remix or transformation of the original work should be licensed under the BY-SA conditions or under any compatible license.

Another set of licenses—specifically crafted for the management of the bundle of rights on databases—has been created by the Open Data Commons (ODC) project.[125] The standard agreements developed by it are: (1) the ODC Public Domain Dedication and Licence (PDDL)[126]; (2) the Open Data Commons Attribution License (ODC-By)[127]; (3) the Open Data Commons Open Database License (ODbL).[128] Their function and content mirrors that of the CC described above, with two main differences: ODC licenses do not cover every genre of intellectual work but only databases, and they are not expressed in the "machine-readable" form.[129]

Even though the ODC licenses are database-specific and should be considered as the more customized legal tool for data, some authors have found the Achilles heels of such agreements exactly in their sectoriality. Considering that they cover just databases and not the content itself, a research repository should necessarily use different types of licenses (one for the scientific publication and another for the dataset supporting that publication), thus creating inconsistencies within the system.[130]

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[124]http://creativecommons.org/licenses/by-sa/4.0/.

[125]The Open Data Commons was one of the first projects in drafting a specific open license for database in 2008 (http://opendatacommons.org/). ODC is now part of the Open Knowledge Foundation, a not-for-profit organization whose associative goal is the promotion of the openness and the sharing of knowledge in its every form. See Pollock and Walsh (2012).

[126]The ODC-PDDL is an irrevocable dedication to the public domain through which the rightholder waives all rights and claims in copyright or *sui generis* database rights over a certain database built in every possible media and formats now known or created in the future. In case the waiver is not valid in a particular jurisdiction, the PDDL includes a worldwide, royalty-free, non-exclusive licence to use the work for any purpose for the duration of any applicable copyright and database rights. See more at: http://opendatacommons.org/licenses/pddl/1.0/.

[127]The ODC-By allows users to freely share, modify, and use the database subject only to the attribution requirements in the manner specified in the license. According to the license, the rights of the user consist in the: (1) extraction and re-utilisation of the whole or a substantial part of the Contents; (2) creation of derivative databases; (3) creation of collective databases; (4) creation of temporary or permanent reproductions by any means and in any form, in whole or in part, including any derivative databases or as a part of collective databases; (5) distribution, communication, display, lending, making available, or performance to the public by any means and in any form, in whole or in part, including any derivative database or as a part of collective databases. Even if tailored on database rights, such a license resembles the contents and the aim of the CC-BY. See: http://opendatacommons.org/licenses/by/1.0/.

[128]The ODC-ODbL is a license agreement intended to allow users to freely share, modify, and use a database while maintaining this same freedom for others. This is realized through the following clause: "4. Any Derivative Database that You Publicly Use must be only under the terms of: i. This License; ii. A later version of this License similar in spirit to this License; or iii. A compatible license". See: http://opendatacommons.org/licenses/odbl/1.0/.

[129]Aliprandi (2011, pp. 35–36), Guibault and Margoni (2013, p. 155) and Leucci (2014, p. 12).

[130]Guibault and Margoni (2013, p. 158).

"Open" licenses are a paradigmatic example of the interaction among different variables: they fit into the copyright and *sui generis* database right domain, but they allow a customization of the right-holder preferences. Thus, such legal tools help in managing the shortcomings of a strong and totalizing IP protection.

Furthermore, they internalize, in a simple and standardized way, some norms of the scientific community: in particular, the option "attribution" reflects a form of reputational reward. This is particularly important, considering that one problem with current credit attribution mechanisms is that they are essentially based on authorship of journal articles.[131]

Thanks to their user-friendly features, open licenses have been successfully adopted for several data access and sharing policies. For example, the Personal Genome Project (PGP),[132] created in 2005 at Harvard Medical School, has set up a scientific database collecting genomic, environmental and human trait data and has licensed the repository under CC0 conditions.[133]

6 The Role of the Researcher: Dr. Jekyll or Mr. Hyde?[134]

The use of the Internet and Web 2.0 has also affected scientific culture, enhancing the possibilities of information disclosure and networking. Nowadays, a researcher has a number of tools—such as blogs, thematic social networks, wikis, etc.—which enable a real-time sharing of his/her thoughts, datasets, analysis, small and negative findings with potentially everybody and without waiting for a traditional publication in a scientific journal.[135] This can produce several advantages: data can circulate more broadly and faster than in the paper-based context, partial results can be cross-checked and validated by several experts, communication enhances the possibility of receiving feedback from a larger community, the disclosure of the so-called "blind-alleys" (negative findings), which of course are never published because unproductive of results, can guide other scientists in their investigations or, at least, avoid the duplication of research in the same deadlock field.[136]

However, a favourable attitude towards sharing is not widespread among researchers, especially in the GS.[137] We have probably to dismiss the Mertonian idea of an investigator moved by high values and/or the public benefit, and the concept of the scientist as a rational individual acting in the interest of the scientific

[131]Ankeny and Leonelli (2015).

[132]http://www.personalgenomes.org/. Accessed 18.10.2014.

[133]http://www.personalgenomes.org/organization/sharing. Accessed 18.10.2014.

[134]Many of the considerations developed in this paragraph were already expressed in Caso and Ducato (2014).

[135]Bartling and Friesike (2014, p. 8) and Rinaldi (2014).

[136]Boggio (2008, p. 10) and Bartling and Friesike (2014, p. 9).

[137]Mboera (2012).

body.[138] In a more cynical way, we have to admit that building a dataset requires huge intellectual efforts, and in the end those data constitute the scientist's "little treasure", which will be used for publishing any significant result. Sharing such information will mean losing a significant competitive advantage and run the concrete risk of favouring the priority of someone else's publication or invention.[139]

If at all, sharing has been practised in the scientific community as a means for ensuring a relationship among two researchers or labs.[140] Put in other words, it has been conceived as a "gift relationship"[141]: a courtesy occasionally made inside a small community of peers, presumably hoping to be reciprocated in the hour of need.

The lack of openness has been in some way challenged by the data sharing policies adopted by several public funding bodies in Europe and the US.[142] Many grant agreements obligate researchers to "grant back" their results and to make their dataset available for re-use. Such conditions are generally fulfilled by uploading research data into a public repository. These policies are an important recognition of the value of data collecting; nevertheless, they only have a limited scope (see for example the opt-out mechanisms in the Horizon 2020 Open Data Pilot) and face a gigantic problem of enforcement. The lack of strict controls and effective sanctions lead to a dilution of the innovative significance of such an institutional effort.[143]

We argue that one the possible solutions for encouraging data sharing lies in creating special incentives for researchers, which internalize reputational rewards.[144] As Ankeny and Leonelli have outlined, current credit attribution mechanisms are shaped around the traditional outcome of a research: the publication.[145] Traditional metrics fail to measure the value of efforts spent in data collection and sharing, leaving this type of work out of their evaluation grids.[146]

In the end, why should a researcher be forced to share his/her dataset with someone else? Why should he/she compromise his/her career? The labour behind such tasks is far from an automated one: it requires time and professional skills, but

[138]As in the Polanyi's view (1962).

[139]Borgman (2007, 2010, 2012), Pisani and AbouZahr (2010), Gitter (2013), Pampel and Dallmeier-Tiessen (2014) and Ankeny and Leonelli (2015).

[140]Ankeny and Leonelli (2015). See also, Reichman and Uhlir (2003, p. 453 and ff).

[141]Ibidem.

[142]Leonelli (2013b). The leading case is represented by the Bermuda Principles, developed in 1996 for fostering the sharing of DNA sequences along the Human Genome Project (Collins et al. 2003). Among the latest examples of data sharing policies, see the "Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020" (http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf) or the NIH "Genomic Data Sharing Policy" (http://gds.nih.gov/03policy2.html). Accessed 18.10.2014.

[143]Ankeny and Leonelli (2015). The lack of enforcement and control mechanisms is critically linked by Frischmann, Madison and Strandburg for the sustainment of a knowledge commons (Frischmann et al. 2014, p. 35).

[144]Caso and Ducato (2014).

[145]Ankeny and Leonelli (2015).

[146]Carlson (2011, p. 293).

nowadays it does not receive any recognition. If we want to make "openness" effective and fair for its players, the challenge is to think up novel mechanisms that bring to the surface the "undeclared work" of: (1) collecting reliable data; (2) sharing them.

In the context of biobanks, for example, Anne Cambon-Thomsen has proposed the creation of a BRIF (*Bioresource Research Impact Factor*), a special citation impact factor for biorepository.[147] Such metrics should "trace the quantitative use of a bioresource, the kind of research using it and the efforts of the people and institutions that construct it and make it available",[148] giving credit to those who created and maintained a valid resource.

In life sciences research, which depends also on the possibility of access to biological samples (which are a scarce resource), we have proposed to think of a "sharing-index",[149] measuring the contribution of a scientist in making his/her dataset available worldwide and rewarding him/her with priority access to the material resources of a biorepository or total/partial waiver of the cost recovering fees.

The recognition of the contribution in creating a dataset would also be functional for accountability purposes, in view of assessing potential responsibilities.[150] Information is valuable only if truthful,[151] so evaluating the accuracy and integrity of data would push competition towards the top and generate as a positive externality the improvement of the general quality of informational resources.

Also, contractual tools can play a role in this context: for example, the use of a license, which recognizes the attribution, would serve to build a reputational reward for the researcher who has decided to share his/her data collection. In this sense, we argue that in drafting data sharing policies it would be preferable to adopt a CC-BY-4.0 or an ODC-By instead of a CC0 or a PDDL. The latter, in fact, would not allow the original contributor to gain credits.

7 Conclusions

With the advancements in science and technology over the last few years, bioinformation has acquired an unprecedented importance and value, not only for the individual to whom it relates for the possible consequences in terms of personalized medicine, but also for the different stakeholders who are interested in something that has become an exploitable resource: the current methods of research in life sciences are characterized, in fact, by a massive and cross-oriented analysis of bioinformation, which is collected, indexed, verified, made available or sold, like a new commodity. The boundaries of IPRs have gradually extended. Scientists tend

[147]Cambon-Thomsen et al. (2011). It represents the evolution of the BIF, Biobank impact factor proposed by Cambon-Thomsen (2003). See also, De Castro et al. (2013).

[148]Cambon-Thomsen et al. (2011, p. 503).

[149]Caso and Ducato (2014).

[150]Ankeny and Leonelli (2015).

[151]Only truthful information generates new knowledge, according to Floridi (2010).

to protect with secrecy and IPRs those resources that until a few years ago were informally exchanged. The privatization of bioinformation is critical because the enclosure movement tends now to encompass the "raw material" of every investigation. Considering the cumulative nature of knowledge, such a commodification can create a dangerous impasse for the scientific progress.

In the current information economy the possibility of accessing and using such data is crucial for innovation and development, but it is even more important for developing countries. For the latter, openness means the possibility of access to a resource that they are not able to create due to the lack of funds, the chance of not being cut off from the international research net, and the hope of decreasing the knowledge gap with the North of the world.

However, the open philosophy is universally preached, but little practiced. As outlined in the paper, there are legal, technological and social obstacles that can explain such a situation: (1) the lack of public investments; (2) the absence of ICT infrastructures or their inability to share and re-use information, hindering the database interoperability or the data portability; (3) a pervasive private control of data through strong IPRs, contracts and technological protection measures; (4) the potential conflict between data protection and open access to bioinformation; (5) the lack of adequate economic or reputational incentives to share information within the scientific community and society in general. The construction of an effective OB policy must consider the interaction of all these factors in order to create a virtuous circle of sharing and a new knowledge commons.[152] We have presented examples of how two obstacles (pervasive private control of data and the lack of adequate economic or reputational incentives to share information) can be mitigated by using combined solutions from different domains.

This is just the first contribution of a more complex study and we are aware of the fact that the most difficult Gordian knot to untie is the interaction with privacy rules. We believe that future efforts of legal scholars must aimed at addressing a fair balance among the interests of data subjects, researchers and the society.

We are not so naive as to argue that the differences between the North and the South of the world would be solved with the adoption of a policy for open access to research data: nevertheless, we believe that this could be a first step in narrowing the current gap and making the informational resources more equally accessible.

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University Knowledge Transfer: From Fundamental Rights to Open Access Within International Law

Valentina Moscon

Only the educated are free
Epictetus, *Discourses.*

Abstract

Education, research, cooperation, and social participation all play a role in innovation as a catalyst for economic and social progress. Universities are among the chief stakeholders in this process. Nonetheless privatization of scientific outputs weakens the benefits of science to society and undermines the norms of science, which are based on accessing and sharing knowledge. Indeed, there is growing disorder in setting university missions whereby IP is evaluated as a value in of itself. Yet, scientific results are a collective achievement, built on vast quantities of publicly funded research and university knowledge transfer occurs mostly through open conferences, databases, and publications. This chapter focuses on scholarly publishing as a segment of knowledge transfer. It will examine open access as a tool that, according to a holistic approach, contributes to establishing a balance among all basic rights at stake, including academic freedom. The idea of a pluralistic system of knowledge transfer where "open" and "proprietary" models are not mutually exclusive will be defended. Moreover, an incentive-oriented copyright change, tailored to the specific needs of research, might be built on the TRIPS flexibility. While TRIPS prohibits discrimination, it does not prevent States from treating different situations differently. Accordingly, we might imagine a paradigm shift in the protection of academic works. Indeed, while moral right is a cornerstone, commercial exploitation of publications is not the aim of academic authors.

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Therefore, applying a "functional" perspective to IP the work should be protectable as long as its market needs to be preserved.

1 Introduction

Now more than ever innovation is driving national states and the international community to deal with information management. The government of innovation as a catalyst for economic and social progress is the battleground of political and social challenges.[1] Education, publicly and privately funded research, social participation and cooperation all play a role. Despite these numerous factors, some of the most direct effects come from Intellectual Property (hereinafter IP). Therefore, IP agenda is a crucial task especially when dealing with university knowledge.[2]

Since IP by its very nature secures the competitive advantages conferred by innovation, demand for IP rights (hereinafter IPRs) is rising worldwide. It is not a secret that, especially in the new information age, policymakers answer industry and entrepreneur requests by providing them with a high level of IP protection. In light of the multilayer regulation of IP that includes international, regional, and national law, this trend is evident in the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)[3] and the treaties reached by the World Intellectual Property Organization (WIPO).[4] They are certainly far more expansive than the IP regulation that was in force in many countries, particularly in developing countries, at the time.[5] The TRIPS agreements, indeed, have imposed a "Western-style IPR regime on developing countries".[6] Indeed, flying in the face of eminent scholars, international legislation has been highly influenced by Western IP–holding corporations.[7] It has been pointed out that, critically designed as the Western IP regime is for the developed world, it is even worse suited for developing countries.[8] It has been almost universally recognized that improperly designed innovation systems including IP regime[9] can prevent filling knowledge gaps.[10]

[1]Carrier (2009).

[2]Reichman (2009).

[3]Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) April 15, 1994, Article 28.1 Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Legal Instruments—Results of the Uruguay Round, vol. 31, 33 I.L.M. 81 (1994).

[4]Word Intellectual Property Organization Copyright Treaty, December 20, 1996, 36 I.L.M. 65 (1997).

[5]See Deere (2011) 34 ff.

[6]Cimoli et al. (2014) p. 1.

[7]Deere (2011).

[8]Cimoli et al. (2014).

[9]Ibid, 5.

[10]Among others see Dreyfuss (2014), Cimoli et al. (2014), Kapczynski (2010).

Furthermore, whether the current approach to IP is generally ideal for developing knowledge is vastly debated from a legal and economic perspective.[11] As the relations between IPRs and innovation in knowledge economies come under closer scrutiny, the proper role of IPRs in overall development policies remains unclear.[12] Even assuming that a strong IP would enrich national income guaranteeing high profits to private companies producing knowledge, this would not automatically create social growth beyond the borders of economics.[13] Indeed, although the concept of "social development" is vague, it is intuitive to think of it in terms of education allowing the construction of satisfied individual identities as a requirement for social participation. In keeping with this, Article 27 in connection with Article 26 of the Universal Declaration of Human Rights (hereinafter UDHR) gives everyone "the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits." It is almost universally felt that social education is a precondition of sound innovation processes. On the other hand, the state's income does not indicate alone the developmental status of a country, which requires translating economic wealth into human well-being to foster social development. Accordingly, while social and economic progress can reinforce one another, economic growth alone when mostly based on private activities that decrease social participation might lead to social impoverishment.[14] Needless to say, by nature industry pursues profits while disregarding those research fields that are not profitable. Just think of the rare disease area in the pharmaceutical sector. Further, IP monopolies, when not regulated, cause abuses of market power and anticompetitive practices. Not only does this result in a distorted, less efficient economy, but, it has been proven by some scholars,[15] even innovation may be hurt, which would go against the putative purposes of IPR.

On the contrary, social development certainly fosters economic development.[16] No matter which channel is employed, the extent and quality of economic progress greatly depend on the education and the learning capacity of society. That is, insofar as economic growth is connected to the extent and quality of domestic Research & Development (R&D) infrastructure, human capacity to innovate is a cornerstone.[17] Furthermore, it is beyond dispute that the pattern of innovation consists first and foremost in accessing and accumulating knowledge and skills that are based on previous separate and complementary information.[18]

[11]Dosi and Stiglitz (2014), p. 1, Dreyfuss (2014), Reichman (2009), Maskus (2000).

[12]See e.g. Chon (2007).

[13]See Antoci et al. (2002).

[14]Ibid.

[15]See Stiglitz (2013).

[16]See Brahmbhatt and Hu (2007).

[17]Grossman and Lai (2002).

[18]See e.g. Cimoli et al. (2014).

Concerns over the implementation of the IP international agenda by both developed and developing nations have increased over the last years. It is not just a question of "strong" or "weak" IPRs. IP is traditionally justified as a mechanism for generating incentives to innovate. Inherent in this instrumental rationale for creating private rights to exclude is the idea that the central goal is the public interest. That is promoting progress for the benefit of society.[19] Article 7 of the TRIPS agreements also conveys theoretically such a principle thus giving a possible interpretative key to the World Trade Organization (hereinafter WTO) members in keeping with the TRIPS flexibility.[20] Indeed, despite the TRIPS "author- or inventor-centric approach" there is considerable room for nations to protect public values in every field of IP including, as for in the subject of this essay, in copyright law on academic[21] works.[22]

Universities are among the most important producers of knowledge and technology and feeders of innovation.[23] Hence, its interactions with other stakeholders, such as for-profit companies, and with society as a whole, need to be carefully considered.[24]

While it is almost unanimously appreciated that innovation depends on the ability to draw from research findings through knowledge and technology transfer (hereinafter KTT), we should never forget that university research is a value in and of itself. Therefore, making research finding publicly available while enhancing teaching through research is the starting point of the value creation. KTT passes mostly through open conferences, databases and scholarly publications.[25] We will focus on publications in this essay, while Caso & Ducato will offer a comprehensive view on issues related to data and database management in universities and research centers.[26]

Thus, copyright law assumes a prominent role in the flow of scientific knowledge. Nevertheless, both from a value-based approach and an author-incentive perspective, applying the copyright utilitarian approach appears misleading. It is worth noting, indeed, that relevant stakeholders' interests significantly diverge from those in other sectors of content production. Commercialization has little to do with incentives for scientists to make research articles available. Researchers have slightly different aims from those who first conceived the utilitarian approach to

[19]Dreyfuss (2014).

[20]Reichman (2009).

[21]The word "academic" in this essay includes not only teaching and research at university but also research and scholarship in independent publicly funded institutions.

[22]See Ginsburg (2003).

[23]The term "university" in this essay refers to a wholly or largely publicly funded research and higher education institution. In a broader sense it may also include private but non-profit research bodies that share common missions and functions around research, teaching and public service.

[24]On the mentioned topic there is abundant economic literature from the last 20 years. See e.g. Albuquerque, Bernardes, (2003), Dasgupta and David (1994), Perez and Soete (1988).

[25]See Nelson (2005).

[26]Ibid.

copyright.[27] Moreover, how we motivate researchers is a different matter than how we finance research. The reason for academic authors to publish research results is mostly reputational rather than economic.[28] They would like to have a positive impact on society. Academic authors might only derive indirect gains in the way of peer esteem and professional advancement.[29] That is, research papers do not need to be protected like a "labor market". In fact, ever since the first scientific journals were founded (in the seventeenth century), publishers have rarely paid authors for their articles.[30] Furthermore, access to, re-use of and sharing of knowledge are the core of scientific methods that also grant freedom of research. Yet, there is growing evidence of the distortion that is likely linked to the undergoing disorder in setting university missions whereby IP is strongly evaluated.[31] Fundamental rights such as academic freedom and the right to access knowledge are under threat from prevailing tendencies that favor the inaccessibility of research finding and foster commercial interests.

These trends are a real barrier for developing countries, which struggle with accessing journals with high impact factor. In the last few decades the costs of purchasing content have increased beyond affordable levels for users in those countries. Since disparity between developed and developing countries is not just about resources but also a gap in knowledge, the acquisition of scientific and technological knowledge is an essential aspect of "catching up". Yet they are currently prevented from participating in the international scientific debate.[32]

This chapter considers, first, scholarly publishing as a segment of university KTT focusing on its present distortions against the fundamental values at stake. Second, it explores the open access (hereinafter OA) movement, as a bottom-up reaction, dealing with the hurdles slowing down its implementation and the possible tools to overcome them. Third, since several communication channels in science might foster academic freedom, we defend the idea of more open access to research and also endeavor to point out that the "open" and "proprietary" models are not mutually exclusive. Within a complex environment the key word is differentiation. According to a holistic approach where IP is only a tool fostering innovation, we will consider a copyright paradigm shift tailored to the specific needs of the

[27]Some scholars argue in favor of abolishing copyright; see Shavell (2010), p. 301, Breyer (1970), pp. 281–355. More generally, while the commodification of science is strengthening, the legal academy is beginning to challenge the idea that intellectual property incentives are necessary at all. See Raustiala and Sprigman (2012), Boldrin and Levine (2008), Barnett (2005).

[28]Some form of compensation may be provided for certain genres, such as teaching materials, handbooks, etc.

[29]See Suber (2012), 29 ff.

[30]There is no empirical evidence that copyright increases authors' earnings. See Towse (2001).

[31]See, among others, So et al. (2014), Dreyfuss (2013), Eisenberg and Rai (2003), Eisenberg (1996).

[32]See e.g. Alperin et al. (2014). More generally on the subject, see Reichman (2009). On international scientific collaboration see e.g. Forero-Pineda (2006).

academic community and based on the idea that "one-size-does-not-fit-all".[33] Such a structural solution might be built on the TRIPS flexibility whereby certain aspects of these agreements are also relevant to university knowledge transfer. An incentive-oriented and also functional approach to copyright will be tailored to the needs of scholarly publishing.

2 Academic Research: A Challenging Arena

> The creatures outside looked from pig to man and from man to pig and from pig to man again: but already it was impossible to say which was which (George Orwell, *Animal Farm*).

While changes are usually made with a view to improving collective wellbeing, they ultimately fail when individuals pursue their own interests and disregard the needs of the community as a whole. In the Orwellian metaphor both humans and pigs have found their common ground, which is being able to become masters of their respective universes. Similarly, the current science management system, especially in developed countries, appears to be the ground on which power derived from the market and other factors, such as research quality evaluation criteria and individual interest in revenue, merge, perverting the nature and functions of academic research.

In recent years academic institutions, first and foremost in the US, have witnessed a transformation by broadening their traditional mission of teaching, research, and disseminating knowledge, becoming more active participants in the market of intangible assets.[34] Although even before 1980 American universities[35] served different practical functions and some even pursued entrepreneurial aims, in the 1970s, during a period of stagflation, university involvement in markets grew.[36] In 1980, the US government passed a significant piece of legislation: the Bayh-Dole Act (BD) coming together with the Stevenson-Wydler Technology Innovation Act.[37] BD assessed measures to facilitate patenting and licensing of research outcomes aligning with the Supreme Court's decision Diamon v. Chakrabarty which stimulated patenting in downstream as well as in upstream research.[38] In particular, the BD Act has allowed universities and certain other institutions to retain intellectual property ownership over any new knowledge resulting from publicly funded

[33]Rai et al. (2012).

[34]See Radder (2010).

[35]See Kerr (1963).

[36]On the side effect of the BD approach in the US, see Dreyfuss (2013), Winickoff (2013), Johnson (2008), Litan et al. (2007), Movery and Sampat (2001). Concerns especially with regard to changing in academic norms such as open, swift, disinterested scientific exchange e.g. in Greenberg (2007), Washbourn (2005), Blumnethal et al. (1996).

[37]Public Law 96-517, 6(a), 94 Stat. 3015, 3019–3027(1980).

[38]See Winickoff (2013). On the transformation of the American university see Kleinman (2013).

research activities and, whenever possible, to license them to industry or start-up companies.[39] Accordingly, US universities have developed policies and technology transfer offices (TTO) to manage the process of reviewing faculty inventions and seeking patent protection.

BD has not just legal but also symbolic value as a license for universities to use their findings to pursue and protect royalty income deriving from IP trade. Similarly, it is worth noting that profiting from exclusive IP licensing does not mean improving the "utilization"[40] of scientific results and technology transfer.[41] Indeed, many studies raise doubts on whether these trends have a concrete positive impact on innovation. While there is no evidence that privatization of publicly financed scientific knowledge has facilitated technology transfer,[42] it has been proven that science is, to some extent, subject to market decisions. Instead of educating for citizenship and having a distinctive noncommercial place in society, universities risk being forged for the interests of the market,[43] without considering that the most important role of universities arises in the future. There are notorious cases where private corporations have gained undue influence on academic research by conditioning the research agenda and questions that were pursued, the data that was collected, the way it was analyzed, and how much of it was published.[44] Let us give an example of a kind of influence private interest could spread on research. In the field of psychiatry, in clinical trials for determining drug efficacy, scientists do not investigate the very nutritional, environmental and social bases of mental issues whose importance is increasingly recognized by practitioners. Indeed, the medicalization of some psychological problems is driven by the pharmaceutical industry and scientists involved in medical trials who have no interest to find out about alternative treatments of mental problems.[45]

[39]"Bayh-Dole effectively shifted federal policy from a position of putting the result of government-sponsored research directly into the public domain for use by all, to a pro-patent position that stressed the need for exclusive rights as an incentive to industry to undertake the costly investment necessary to bring new products to market". National Academy of Sciences (1997), p. 3.

[40]About "utilization" of research findings see Petrusson (2009).

[41]See So et al. (2014). The authors highlight that BD "provided the means, by expanding eligibility standards to include basic research and research tools… Rather than promote commercialization, these patents on basic research platforms constitute a veritable tax on commercialization".

[42]So et al. (2008).

[43]Kleinman (2010).

[44]These types of issues figured centrally in the Berkeley-Novartis relationship in the late 1990s and in the case of Betty Dong, a University of California San Francisco researcher studying the efficacy of a thyroid medicine. Boots Pharmaceutical, the funder of Dong's work and the manufacturer of Synthroid, engaged in a sustained campaign to prevent Dong from publishing results that showed that Boots' drug was no more effective than three cheaper competing drugs. See Washburn (2005), Krimsky (2003), Rudy et al. (2007). See also Brown (2013).

[45]Musschenga et al. (2010).

Besides, significant amounts of scientific understanding and technique become private property rather than publicly available resources (because of private funding or private acquisition).[46] For example, a conflict of interests emerges when university researchers are involved with a private company. Most of the agreements between academic institutions and companies indeed require that university investigators keep information confidential for a long period of time, more than necessary for the purpose of filing a patent. Also, it is a common practice to conduct a pre-publication review of any research articles generated in a research project involving a private company either in the research stage or in the commercialization phase or simply by sharing researchers working on the joint project.[47] In similar circumstances researcher's mobility could be restrained as well because of the know-how they have acquired from the research body in doing that research.[48] Moreover, in many university research labs that have commercial relations with industry, secrecy provisions are being implemented so that sharing techniques and results with visiting scholars is likely to be restricted.[49] Indeed, IP and contract rules as applied in academia strengthen secrecy of scientific finding. Therefore, the assumption according to which knowledge is the most important input to knowledge development appears to be de facto underevaluated.[50]

Thus, for those who see ambiguous virtue in increasing the role of the entrepreneurial university the emerging reality is troublesome.[51] According to them, in addition to taking part in the creation of new business, universities have several functions. They have the responsibility of educating students and contributing to scientific knowledge of the world; delivering research that will actively support the interests of industry and society; participating as key stakeholders in the development of the arenas for research and innovation. Providing educated students, diffusing knowledge on scientific results and engaging in societal dialogue should all be inspirational values in academia.[52] Similarly, welfare and wealth development, social sustainability, democracy and transparency, fair and non-discriminatory social order, culture and education, morality and responsibility are all principles that should be at the core of academia.

On the contrary, the approach that aims to enhance privatization of scientific knowledge assets contributes to a change in academic norms regarding open and disinterested exchange. Although some analysts suggest that science, even without

[46]A study among German life scientists showed that those who receive industry funding are more likely to deny others' requests for access to research materials. See Czarnitzki et al. (2014).

[47]Blumnethal et al. (1996).

[48]Dreyfuss (2013).

[49]See Forero-Pineda (2006).

[50]See Stiglitz (2008).

[51]See e.g. Slaughter and Rhoades (1996), Nelson (2001), Geuna and Nesta (2006). Some authors argue that engagement in university-industry relations produces high-quality research output because these activities have positive effects. See Thursby and Thursby (2011), Van Looy et al. (2004), Etzkowitz and Leydesdorff (2000).

[52]Petrusson (2009).

pressure from corporations, does not directly follow Merton's norms of science, we certainly now face an "epidemic of anti-Mertonian behavior".[53]

Nevertheless, the emergence of the entrepreneurial university model has urged several nations including European countries and, more recently, developing countries,[54] to reinvigorate their own universities in this direction.[55] Some of them have the explicit goal of generating revenue for public-sector research institutions.[56] In fact, interpreting academic success as bringing in money, universities are interested in joining forces with the private sector making tangible short-term contributions. Moreover, if universities are interested in being successful, a simple (but perhaps simplistic) quantitative approach makes it seemingly easier to measure universities' achievements.

Furthermore, in many economies, governments are feeling the strain of allocating limited resources to divergent requirements and universities are no longer an inviolable investment, free from the critical evaluation of cost effectiveness. Meanwhile, over the last few years several forces came together to create increasing incentives for firms to work with universities for research and development. A call for returns on investments and reduced time to market added to the pressure on firms to use output from R&D that takes place outside their own walls. Consequently, as pointed out above, the domain of public science has been encroached upon, challenging the university mission. Accordingly, while knowledge is transferred from universities to the outside world through many diverse channels,[57] university knowledge transfer turns out to be mainly a university technology transfer based on buyer-seller transactions at market prices.

The interest in the pursuit of profit through selling the expertise of scientists and research findings is a crucial aspect but only one part of a broader phenomenon that has been identified as "academic commodification". This refers to a comprehensive, cultural and social development in which all kinds of scientific activities and their results are predominantly interpreted and assessed on the basis of corporate criteria.[58] Thus it has been duly noted that what is more significant than formal university-industry relations is the indirect but pervasive impact of commercial codes and practices on academic culture.[59] This all has to do with the ethos of science.[60] Vallas and Kleinman found that "sharpening competition for professional distinction, combined with the entrepreneurial ethos driven by the scramble for

[53]See Mitroff (1974), Mulkay (1980).

[54]Recently, countries from China and Brazil to Malaysia and South Africa have passed laws promoting the patenting of publicly funded research and a similar proposal is under legislative consideration in India. See Nezu (2007), Srivastava and Chandra (2012).

[55]See e.g. So et al. (2014), Dreyfuss (2013), Nezu (2007), Forero-Pineda (2006), Correa (2005), Cruz (1998).

[56]See Reichman et al. (2008). As for the Italian situation, see Arezzo (2013).

[57]Matkin (1990).

[58]Radder (2010).

[59]Kleinman (2010).

[60]Radder (2010) pp. 231 ff.

scarce dollars, which has yielded increasingly potent barriers to the sharing of knowledge among scientists in the same or similar fields".[61] In fact, commodification is not only pushed from outside. The universities themselves are actively engaged in profit-seeking activities disregarding a necessary value-based approach. The ongoing process results in phenomena such as commercialization, contract research, privatization, patenting, trade secrets, scientific productivity, and the "publish or perish" culture that most universities in the Western world have experienced, also influencing the developing world.

As for the publishing system, private control over scientific literature is growing and is being strengthened by the management of data relating to it.[62] Indeed, while the impact of scientometric indicators on the direction and content of academic research has strongly increased, the largest bibliometric databases, such as ISI Web of Science (Thomson Reuters) and Scopus (Elsevier), are composed and exploited by private firms.[63] Therefore it is likely an influence of the commercial interest of companies on the construction and uses of such databases. The aforementioned quality rating system for publications merges the power stemming from the market[64] and that derived from research quality evaluation criteria, through copyright ownership. We will come back to this presently.

Privatization and economic instrumentalization of scientific publications is a topical issue, since it weakens the benefits that science could bestow on society and undermine the social norms at which science should be aimed. Private stakeholders own and exclusively profit from scientific results that are in fact a collective achievement, built on a vast amount of publicly funded research results.

How these tendencies are reorienting universities towards society and redistributing access to knowledge is a critical matter not just for universities themselves, but for democracy and the public sphere.[65]

2.1 The Case of Scholarly Publishing

In the 1960s, scientific publishing began to be a profitable business for commercial publishers. According to Jean Claude Guédon,[66] the archetype of scientific journals was born as a "public registry" of discoveries, i.e. a system to assign "scientific paternity" and priority, thus resolving the issue of authorship of original ideas. The subsequent progress made in the scientific publishing industry led to a consolidation on the market to a few dozen major publications, each of them addressing a specific subject. It was then in the late 1960s that the concept of core journals

[61]See Vallas and Keinman (2008).

[62]See Moscon (2015), Reichman and Okediji (2012), Hilty (2006).

[63]Leydesdorff (2008), p. 282.

[64]Horowitz (2007).

[65]Winickoff (2013).

[66]Guédon (2001).

emerged, and to this day all researchers still prefer their works to be published in them.[67] Hence publishers have created markets with a broad and stable institutional customer base, also favored by the growing number of libraries and universities.[68]

The advent of digital technology and the Internet saw a radical change in the way scientific communication works. Major commercial publishers seized the opportunity to extend their control over content, also benefiting from technology and e-publishing. Thanks to digital technology, right holders can grant users access to and use of information under specific conditions guaranteed by technological protection measures (TPM)[69] and digital rights management (DRM) systems.[70] In the scientific publishing industry, the most common contract format is the end-user license agreement (EULA),[71] which mirrors the business model produced by digital technology and allows control over information. Such a powerful legal device is driven by a commercial and proprietary rationale, aimed at restricting access to content.[72] EULAs normally prohibit any form of redistribution of content, causing secondary markets to disappear and strengthening the oligopolistic power of major scientific publishers.

It was on this basis that, by the 1990s, a small handful of international publishing companies came to control distribution of the most widely read and prestigious academic journals. There has been a steep rise in subscription fees for major scientific journals. Since universities and public libraries are unlikely to buy all publications, they end up investing in the most important journals according to the quality rating system for publications, thereby favoring the market concentration even further.[73] Once a journal establishes itself as a "must have" title in its subject area, libraries will continue to purchase the title even if the price increases.

The paradox is that universities themselves subsidize the production of much of the research and scholarship published in academic journals. Since scientists normally underestimate the importance of their rights while creating a work,[74] especially their economic rights, and want to publish in "good" journals, they then transfer copyright for free to the publisher, who later licenses them to research institutions at high prices and on strict terms and conditions of access and use of the content.[75] In fact, all scientists, given the evaluation system, want to publish their work in the most prestigious journals. This phenomenon is prevalent in the scientific areas that make use of periodicals and bibliometric indices (such as the impact factor and the h-index) but is also found in the humanities and social

[67]Russel (2008).

[68]For more details, see Priest (2012), pp. 10 ff.

[69]See Moscon (2013a).

[70]Reichman and Okediji (2012).

[71]Among others, see Rice (1990), p. 157, Lemley (2012).

[72]From a critical perspective, see Hilty (2006) pp. 180 ff.

[73]Horowitz (2007) p. 38.

[74]Caso (2013b), Jordan (2003) pp. 15 and 92.

[75]Suber (2012), pp. 129 ff.

sciences, the so-called non-bibliometric sectors, which are making increasing use of similar tools, such as listing journals according to quality categories, taking account of the publisher's prestige.[76] In the scenario described, it also happens quite often that authors offer their contribution to journals and book collections for free as members of scientific committees and as auditors to the peer-review process organized by publishers.

The current trend threatens not only innovation and productivity but also scientific freedom, the latter in any case being the premise for promoting the former. Researchers who need to draw from many databases to conduct research are aware of the difficulty of dealing with a myriad of divergent and overlapping policies, agreements, and laws, as well as parsing incomprehensible fine print that often carries conflicting obligations, limitations, and restrictions. These licenses and agreements can hinder research and also potentially enable data providers to exercise "remote control" over downstream users of data, likely dictating what research can be done and by whom, what data can be published or disclosed, what data can be combined and how, and what data can be re-used and for what purposes. Imposing that kind of control imperils the very foundations of science, which is grounded in freedom of inquiry and freedom to publish.

From this perspective, the traditional scientific publishing industry appears to be neutralizing the very revolutionary power of digital technology and the Internet that would help increase knowledge dissemination, improve the preservation of publications over time, and create new business models and value-added services. So while on the one hand new technology has the potential to increase and accelerate access,[77] on the other it is being exploited in the market of scientific publishing to produce the opposite effect.

The dominant position of publishers on the market is due to many factors, some of which we have touched upon above. Among them is the evaluation of scientific publications, which is linked to the traditional functions of scientific journals, including quality certification, awareness, archiving and, historically, registration.[78] Certification and awareness functions are currently under discussion while still relying heavily on the traditional communication system based on the concept of core journal. This method, also known as the "gatekeeper model"—the system of deciding on the quality of works before publication based on both publisher policies and peer-review practice—raises many issues. First, it predefines its audience and disregards a series of important questions, such as how the value of the material that is pre-excluded can be fully known, given that the reviewers will likely embrace ideologies that are not always explicitly clear from their immanent position. Furthermore, it seems reasonable to wonder what value will be established by gatekeepers in the future. Finally, there are concerns with concentrating the power of evaluation in academic disciplinary groups in a way that, in a possibly unhealthy

[76]See Caso (2013b).

[77]On Internet developments, see Berners-Lee (1999).

[78]Roosendaal and Geurts (1997).

environment, might combine academic authority and political control while also avoiding public quality evaluation. That is, whoever currently holds the gate-keeping role could likely be worried about a more transparent publishing system breaking up a well-established scheme.[79] A mismatch between the general interest and the individual's behavior is imaginable.

In this scenario, traditional publishers are also trying to defend their position on the market by promoting accessory services for scientific product evaluation. Indeed, the method for measuring the impact of scientific production in terms of quantity is becoming increasingly powerful and sophisticated, thanks to data analysis techniques. Control over scientific literature, therefore, is also being strengthened by the management of the data relating to it. It follows that data management is acquiring great importance at a global level. One example of this is the abovementioned management of databases like ISI Web of Science (Thomson Reuters) and Scopus (Elsevier).[80] That quality rating system for publications[81] merges the power derived from research quality evaluation criteria with that stemming from the market,[82] creating a centralized management of scientific knowledge.

This phenomenon deserves even more attention in developing regions, where a high percentage of scientific research results are published in local languages, in local and regional journals, research reports, books, and theses. That is especially true with regard to social science.[83] Hitherto, only a very small fraction of these publications are included in the "international" indices that in developing regions as well produce the most widely used indicators to evaluate individual and institutional research outputs. Moreover, research in developing regions is almost exclusively government-funded, primarily through national or federal state agencies and to a lesser extent by international cooperation agencies.[84] These two patterns are in contrast to the limitation that the most widely used and accepted scholarly indicators to evaluate research output and impact in developing regions are provided by indices that are "international", where only a small fraction of journals from developing regions are included. The lack of indicators that cover journals

[79]Caso (2013b).

[80]An avenue of enquiry opens up here regarding the management and protection of databases that becomes even more relevant with regard to big data.

[81]Strong criticisms against the use of Thomson-Reuters' Journal Impact Factor (IF) to evaluate research output in general has been shown in the San Francisco Declaration on Research Assessment [DORA, http://www.ascb.org/dora/], 2012. Criticism specific to its use in evaluating research productivity outside of Europe and North America in Alperin et al. (2011), Gúedon (2008), Vessuri et al. (2013).

[82]Horowitz (2007), p. 38.

[83]Take, for example, the case of the social sciences in Argentina, where the percentage of articles published in local and regional journals is as high as 80 % (Gantman 2011). In Latin America more broadly, over 50 % of the journals identified by Latindex (a Directory of journals published in Latin America) are from the social sciences.

[84]Alperin et al. (2014), UNESCO (2014).

from developing regions hinders the ability to evaluate their individual and institutional research output.

The two commercial databases mentioned are highly oriented towards publications from traditional scientific commercial publishing in the United States and Western Europe, to the detriment of publications from other regions, and languages other than English.[85] It is beyond the scope of this chapter to discuss to what extent English is currently the scientific language, but there is no doubt that in developing countries, as well as in many scientific disciplines, there are many publications in national languages. The privileging of English as the language of publication is one of the many distortions of the commercial scientific databases focused on the North. Scopus and Web of Science have been the key players in establishing standards of quality. Both of these commercial databases underestimate the scholarly production of the developing regions and provide a skewed and misleading picture of the publishing activities of those countries.[86]

On the other hand, the excessive cost of acquiring scientific journals and databases makes it difficult for researchers from developing countries to access content, preventing them from exchanging research results and developing international relationships.

3 Scientific Publications Within University Knowledge Transfer

The abovementioned practices fostering privatization of research outputs require even more attention in the current global knowledge-based economy.[87] Wealth is being created by intellectual capital that stems greatly from public research institutions where cooperation occurring within networks of formal and informal relationships is a pervasive feature.[88] Scientific products can be transferred from universities to the outside world through many diverse channels including patenting and licensing, university spin-offs, equity ownership in research-based companies, industrial *liaison* programs, consultation of faculty members, etc. Nonetheless, empirical studies have proven that dissemination of research results through publications and open conferences are the most important means of communication favoring transfer of knowledge and building of networks. From these open channels even industry has learned of and gained access to results of public research, getting most of its benefit from academic science.[89] This empirical and conclusive observation is not at odds with theoretical work stressing the importance of interfaces between science and technology for the consolidation of a national innovation

[85]Testa (2012).

[86]Ibid.

[87]Desantes Real (2011).

[88]As for the role of collaboration within the present research activities, see the OECD (2013) and the Royal Society reports (2011).

[89]Cohen (2000), Agrawall and Henderson (2002).

system. In this regard the Royal Society stated "The scientific league tables are not just about prestige—they are a barometer of a country's ability to compete on the world stage".[90] This is especially true for upstream research that by nature fosters knowledge inputs producing further outputs including downstream research.

Academic research significantly diverges from other sectors of content production and technology transfer. First, academic culture and ethics are different from commercial ones. Scientists are traditionally motivated by curiosity and reputation.[91] Second, the academic community is ideally driven by specific values at the foundation of the scientific method.[92] According to them, what matters is the advancement of scientific knowledge, which must be evaluated by both individuals and the community through exchange of ideas and intellectual debate. Therefore, academics care about publishing research outputs more than exploiting them commercially. That is proven to some extent by empirical research.[93]

Similarly, the majority of academic research is publicly funded through both research projects funding and researchers' salaries. Indeed, rewarding scientists *ex ante* and ensuring job security likely allows development in all fields of science,[94] achieving objective findings, and disseminating these whenever and however researchers like.[95] This is closely bound up with the protection of academic freedom that is promoted through several means, also by granting broad access, free dissemination, and reuse of scientific outcomes. In this respect, the principles upon which academic freedom is founded must be elaborated in ways that are relevant to the responsibilities and circumstances of today's universities.[96] Certainly now more than ever IP and academic freedom are in a strong and complex relationship that would likely need to be settled considering the nature of the various rights at stake.[97]

Freedom of science and the right to teach are considered a means of ensuring cultural and social growth.[98] Thus, academic freedom mirrors the image of scientists as serving the society as a whole and not particular interests, so that universities respond to the comprehensive needs of civil society. Academic freedom is protected as a fundamental right by international treaties and by several Western constitutions. In the following section, we will briefly try to define that freedom by describing its connections with IP rights in academia. We will turn to the German

[90]Royal Society Report (2011).

[91]Dreyfuss (2013).

[92]Merton (1973).

[93]This also emerged from a study by the Commission of the European Communities, Brussels, January 14 2002, in which the potential conflicts between "publishing" and "patenting" strategies were considered.

[94]See Tartari and Breschi (2012) p. 1117.

[95]Ludington (2011a) pp. 397–432.

[96]About that need in the US environment, see Atkinson (Atkinson 2004).

[97]On this point, see Hilty et al. (2009), p. 309. According to the EU Commission, the authors mentioned refer to "a Fifth Freedom" that would set a new paradigm regarding the free circulation of knowledge. This is particularly relevant for scientific information and knowledge.

[98]See Dershowitz (2005).

approach in which academic freedom is highly regarded especially after the Second World War. Its relationship with IP in academia has been taken into account by legislature and case law.[99] Indeed, even the US concept of academic freedom originated in the Teutonic legal order.[100]

The German Constitution (Gruendgesetz fuer die Bundes Republik Deutschland —GG)[101] establishes in Article 5(3) that "Art and scholarship, research, and teaching shall be free …" The constitutional legislature upholds any scientific research regardless of the source of funding and of who conducts the research activity. The expression "research freedom" (*Wissenschaftsfreiheit*) is interpreted as referring to both research and teaching, which are at the interface of IP law, right of ownership (*Eigentumfreiheit*),[102] freedom of information (*Informationsfreiheit*)[103] and freedom to exercise a trade and profession (*Berufsfreiheit*).[104] Article 5(3) protects both the freedom of individuals to practice research and teaching and public interest in the advancement of knowledge. Indeed, outputs achieved by methodological, systematic, and verifiable research means are conveyed to the community through teaching and publishing.[105] Therefore communication means including the publication process are also protected under Article 5(3) GG. Since scientific knowledge and progress are not the work of a single scientist, sharing results seems to also be constitutionally protected.[106] From this perspective, Article 5(3), by granting the right to disseminate research outcomes, gives authors the right to choose the place, time, and manner of their publication and publishers should be at the service of this constitutional right.[107]

Academic freedom affords scientific authors a special protection in conjunction with intellectual property law whose patrimonial aspect, which includes the right of commercial exploitation, is grounded in principle in Articles 14 GG (right of ownership) and 12 GG (freedom to exercise a trade and profession). According to the prevailing view,[108] then, the commercial use of research results does not fall

[99]It is intriguing to note that the idea of academic freedom, born in the German universities of the early nineteenth century, was substantially limited by political and social restraints and conditioned by German nationalism. See Herbst (1965).

[100]See Atkinson (2004), Commager (1963), p. 361.

[101]Grundgesetz für die Bundesrepublik Deutschland vom 23. Mai 1949, Article 5(3): "Kunst und Wissenschaft, Forschung und Lehre sind frei. Die Freiheit der Lehre entbindet nicht von der Treue zur Verfassung." The constitutional provisions that explicitly proclaim the freedom of research in European countries are directly related to the events of the Second World War. See Santosuosso et al. (2007), p. 342.

[102]See Article 14(1) of the German Constitution.

[103]See Article 5(1) of the German Constitution.

[104]See Article 12(1) of the German Constitution.

[105]See Lutz (2012), Leinemann (1998), 53 ff.

[106]Pernice (2004), pp. 28 ff.

[107]Steinhauer (2010), pp. 43 ff., Fehling (2010), p. 74, Jarass and Pieroth, pp. 122 ff.; Sanberger (2006), pp. 818 and 820, Krasser and Schricker (1998), pp. 128 and 152.

[108]Pflueger and Ertmann (2004), pp. 436 and 441.

within the scope of academic freedom. Indeed, researchers pursue interests other than commercial ones: first and foremost for scientists are exchange of knowledge, research development, and the reputational impact of their works. These aspects, which are uncontested and in some ways proven by empirical research,[109] are thus protected by Article 5(3) GG. Meanwhile, in areas concerning both commercial interests and research freedom, Articles 12, 14, and 5 GG are applied in a balanced way.[110] This matter also emerges, for example, with regard to Article 42 of the German Employee Inventions Act (*Arbeitnehmererfingungsgesetz*—ArbEG[111]), as amended in 2002, which regulates the economic rights of patentable scholarly works. According to it and contrary to the prior approach that provided for a privilege for researchers and professors (*Hochschullehrerprivileg*),[112] all inventions by employees have been equally regulated since 2002, without any privilege for professors.[113] The view taken by the legislature is that, while provision has to be made to reward authors for their creative efforts,[114] the right to commercialize IP rights is likely not protected as an aspect of academic freedom. In support of this rule, the legislature pointed out that "The fundamental right recognized by Article 5 of the Constitution does not require research results to be attributed to the researcher, since freedom of research does not include the right to commercial exploitation of the invention."[115] On the other hand, publishing research outputs is recognized by the German legislature as being independent from their commercialization. In fact, the German Employee Inventions Act contains special provisions for both the "positive" and "negative" freedom to publish, assuming that the right of "whether and when" to publish is in the hands of scientists. Publishing research outputs is recognized by the legislature as being independent from their commercialization.[116] Indeed, according to the general view, for works created by faculties copyright on scientific publications is allocated to the author.[117]

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[109]This also emerged from a study by the Commission of the European Communities, Brussels, January 14 2002, in which the potential conflicts between "publishing" and "patenting" strategies were considered.

[110]Fechner (1999), pp. 288 ff. and 328, Bethge (2009), 220 ff.

[111]See Article 42 of the ArbEG.

[112]An overview of this topic is found in Guarda (2013).

[113]"Anderung des Gesetzes u ber Arbeitnehmererfindungen," Bundesgesetzblatt Teil I, Nr. 4, January 24 2002.

[114]See Article 42(4) of the ArbEG.

[115]"Das Grundrecht des Artikels 5 Abs. 3 GG gebietet zwar nicht die Rechtsinhaberschaft des Hochschullehrer an seinen Forschungsergebnissen, denn die Forschungsfreiheit umfasst nicht das Recht auf kommerzielle Nutzung von Wissenschaft-Erfindungen," BT-Dr 14/5975 of 9 May 2001; BR-Dr 583/01 of August 17 2001.

[116]On the relationship between the commercial exploitation right and the right to publish in the light of academic freedom, see Moscon (2015).

[117]See, Herrera Diaz (2010), p. 95; Ulrici (2008), pp. 205 ff.; Pramann (2007), pp. 46 ff.; Schricker and Krasser (1998), pp. 419 ss. Heerman (1999), p. 468; Haberstumpf (2001), pp. 819 and 826. As for the UK legal system, see Rahmatian (2014); for Spain, see de Roman Perez (2012); for France, see Lucas–Schloetter (2008).

At an international level, the academic freedom as a fundamental right as well as its legal protection is closely connected with freedom of thought, expression, and information[118]; the right to education,[119] to participate in cultural life,[120] to enjoy the benefits of scientific progress and its application.[121] Academic freedom enjoys proper protection relating to both researchers' independence from any external influence and the autonomy of research entities and universities from political and economic power. These features help to reinforce one another: institutional autonomy fortifies the individual one and vice versa.[122]

Academic freedom in its broader meaning, which includes freedom of research and teaching, serves the common good by fostering independent thought and expression among researchers and students, who are free to spread ideas, arguments, and conclusions that may be reached in any studies or investigations.[123] Objectivity, systematic research and scientific rigor are all aspects of this freedom, which are strengthened by communication of scientific outcomes.[124] Indeed, within international law a first concern with regard to scientific research has to do with access to findings. Article 27(1) of the abovementioned UDHR focuses on the beneficiaries of science, as does Article 15 (1–3) of the International Covenant on Economic, Social and Cultural Rights (1966), which states that "(1) The States Parties to the present Covenant recognize the right of everyone: […] (b) to enjoy the benefits of scientific progress and its applications; (c) To benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author […] (3) The States Parties to the present Covenant undertake to respect the freedom indispensable for scientific research and creative activity."

In the European context, Article 13 of the CFREU strengthens the international framework establishing that "The arts and scientific research shall be free of constraint. Academic freedom shall be respected." According to the explanatory memorandum[125] of the CFREU, that right "is deduced primarily from the right to freedom of thought and expression". Furthermore, although the European Convention on Human Rights (ECHR) does not contain any explicit definition and guarantee of academic freedom, it enjoys the protection provided by the abovementioned Article 10(1) ECHR "… This right shall include freedom to hold

[118]As Connolly observes, "academic freedom is a kind of cousin of freedom of speech" Connolly (2000), p. 71. In the same direction, Daughtrey (1991), pp. 213–271. See also Turner (1988).

[119]See the UDHR, Article 26 and the International Covenant on Economic Social and Cultural Rights (ICESCR), Article 13.

[120]See the UDHR, Article 26 and the ICESCR, Article 15 (1)(a). A right to share in cultural life is also found in Article 30, Convention of the Rights of Persons with Disabilities, 2007.

[121]ICESCR Article 15 (1)(b).

[122]For a comparative analysis of academic freedom in terms of both individual and institutional independence, see Karran (2007).

[123]See Robertson (1977–1978), p. 1204.

[124]See Monotti and Ricketson (2003).

[125]"Explanations relating to the charter of fundamental rights" (2007/C 303/02).

opinions and to receive and impart information and ideas without interference by public authority and regardless of frontiers …" According to paragraph 2,[126] this freedom is limited only to the extent that is reasonable in the public interest.

Academic freedom also figures prominently in the activities of the European Council. In 2000, the Committee of Ministers adopted a recommendation underlining aspects of academic freedom,[127] while the Parliamentary Assembly of the Council of Europe in 2006 adopted a recommendation exhorting the Committee of Ministers to "strengthen its work on academic freedom and university autonomy as a fundamental requirement of any democratic society."[128]

Moreover, according to a fundamental principle of the Magna Charta of European Universities independence means self-government through the community of academic members: "[t]he university produces, examines, appraises and hands down culture by research and teaching. To meet the needs of the world around it, its research and teaching must be morally and intellectually independent of all political authority and economic power. Freedom in research and training is the fundamental principle of university life. Governments and universities, each as far as in them lies, must ensure respect for this fundamental requirement."[129]

If the grounds for academic freedom are a common interest in technological and social development, the same aim should guide legislative choices in the protection of intellectual property. In fact, even in international IP law, the need to balance the fundamental rights at stake in favour of knowledge transfer and innovation is emphasized. Suffice it to recall what Article 7 of the TRIPS agreements establishes: "the protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations."[130] This provision makes it clear that IPRs are not an end in themselves, clearly establishing that the protection and enforcement of

[126]See Article 10(2) ECHR: "The exercise of these freedoms, since it carries with it duties and responsibilities, may be subject to such formalities, conditions, restrictions or penalties as are prescribed by law and are necessary in a democratic society, in the interests of national security, territorial integrity or public safety, for the prevention of disorder or crime, for the protection of health or morals, for the protection of the reputation or rights of others, for preventing the disclosure of information received in confidence, or for maintaining the authority and impartiality of the judiciary".

[127]Recommendation (2000), p. 8 of the Committee of Ministers of March 30 2000 on the research mission of universities, adopted at the 705th meeting of the Ministers' Deputies.

[128]Recommendation (2006) 1762 of the Parliamentary Assembly of June 30 2006 on academic freedom and university autonomy, adopted by the Assembly on June 30 2006.

[129]The Magna Charta of European Universities is the final outcome of the proposal put forward by the University of Bologna, in 1986, to the oldest European universities. The document, drafted in Barcelona in January 1988, was signed by several universities. The document is available at http://www.magna-charta.org/cms/cmspage.aspx?pageUid1⁄4{d4bd2cba-e26b-499e-80d5-b7a2973d5d97}.

[130]See Yu (2009), pp. 979 ff.

intellectual property rights do not exist in a vacuum. They are meant to benefit society as a whole and are not aimed at the mere protection of private rights.[131]

In this scheme of things, given that academic freedom protects a social interest, it seems reasonable that copyright and the academic publishing system are established in such a way as to effectively ensure dissemination of and access to scientific knowledge.

4 Open Access

The OA paradigm has developed in a bottom-up process,[132] thanks to initiatives promoted by some scientific communities[133] and librarian groups. Declarations,[134] policies, and contracts and the further implementation of statutes in some legal systems have shown the growing global interest in OA principles. The foundations of OA are provided by three main declarations: Budapest (2002), Bethesda (2003), and Berlin (2003). The last one encompasses the most comprehensive definition according to which OA grants access to all academic works, free of technological, legal, and economic barriers, thus also reducing the costs arising from the publication process. Free access to content and some basic economic rights through free, irrevocable, and worldwide licenses subject to the attribution of authorship are therefore pillars of OA. Furthermore, appropriate technological standards to ensure long-term archiving and interoperability are crucial to the development of OA.

The two main approaches to OA are the gold road and the green road. The first one is defined by the literature as "scholarly work published *ab origine* on an OA basis," while the second is referred to as "(self-)archiving in OA repositories of published, peer-reviewed articles."[135] Authors opting for the green road can publish their work through traditional channels and then disseminate it through OA repositories, either institutional or disciplinary.[136] Currently, many journals allow OA republication, only requiring an "embargo period," i.e., the time between the first publication and the OA re-publication. How long it is depends on the discipline

[131]Council for Trade-Related Aspects of Intellectual Property Rights (2001), Submission by the African Group, Barbados, Bolivia, Brazil, Cuba, Dominican Republic, Ecuador, Honduras, India, Indonesia, Jamaica, Pakistan, Paraguay, Philippines, Peru, Sri Lanka, Thailand and Venezuela, IP/C/W/296, para 18.

[132]For a comprehensive review of the OA literature, see Frosio (2014).

[133]Open access principles arise from some scientific communities, such as physicists, in which sharing articles is an established practice. See the arXiv repository at http://arxiv.org/.

[134]See Berlin Declaration 2003, available at http://openaccess.mpg.de/286432/Berlin-Declaration. At the European level, see EU Recommendation 17 July 2012 (2012/417/EU) on access to and preservation of scientific information. In the US, Revised Policy on Enhancing Public Access to Archived Publications Resulting from NIH-Funded Research, available at http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-033.html.

[135]See Harnad et al. (2004).

[136]See The Directory of Open Access Repositories—OpenDOAR, at http://www.opendoar.org/.

and the policy of the publisher.[137] Meanwhile, publishers support the so-called hybrid road allowing for the OA publication of articles (known as open choice) in closed-access journals, against payment of the article processing charges (APCs)[138] by the author or the institution financing the research.[139]

A further distinction may be made between weak forms of OA (i.e. *gratis* OA), which eliminate only the economic barrier to access, and strong forms (i.e. *libre* OA), which, as stated in the Berlin Declaration, also lower the legal barrier to restricted access to and use of scientific contributions.

The benefits of OA[140] include speed, efficiency, and extent of content dissemination; strengthening of interdisciplinary research; collaboration between different scientific disciplines; transfer of knowledge to businesses; transparency towards citizens; and preservation of research results over time.

That said, OA is not against the traditional scholarly publication system[141]: it does not replace peer review, and it does not ignore the fact that any publication involves costs that must somehow be recovered by authors or research institutions. However, the role of publishers may change under the OA paradigm; they may provide a service that would be differently rewarded preserving copyright to the authors. Publishers might also develop new services, related, for example, to the storage of content and the development of data mining techniques facilitating retrieval of documents and other services that value the technological means.[142]

OA enhances pluralism of information sources and perhaps also of public research evaluation. Indeed, as scholarly communication moves increasingly online, more indicators have become available. The storage of research results can lead to improvements in the research evaluation systems, creating new criteria that might serve as a basis for pluralism also in the evaluation of academic works.[143] Participation by the academic community offers tools that are different to "traditional" peer review, namely open, documented peer review that usually takes place at a post-publication stage, therefore giving readers access to a live and ongoing

[137]See Millington (2011). A list of journals that allow OA re-publication is available at http://www.sherpa.ac.uk/romeo/PDFandIR.html.

[138]Björk and Solomon (2014), Final Report to a consortium of research funders comprising Jisc, Research Libraries UK, Research Councils UK, the Wellcome Trust, the Austrian Science Fund, the Luxembourg National Research Fund, and the Max Planck Institute for Gravitational Physics. Available at http://www.wellcome.ac.uk/stellent/groups/corporatesite/@policy_communications/documents/web_document/wtp055910.pdf.

[139]Hybrid OA has met with some criticism from the literature. The risk is having to pay twice: first, when the author or the institution pays extra APCs in order to have their papers appear without the gatekeeping charges and, second, because libraries and institutions still have to pay for the journal subscription. See Adams (2007), Bjork (2012), p. 1496.

[140]See Suber (2012), pp. 65 ff., Herb (2010).

[141]On the interfacing between open and private models, see Hilty and Köklü (2013).

[142]Ohly (2014), 75 ff.

[143]See Altmetric Manifesto at http://altmetrics.org/manifesto/. See Eve (2013).

literature review.[144] Post-publication review through online commentary and social media in communicating published works and discussing their merits and weaknesses might play an important role. In the case of so-called interactive OA, for instance, pre-print and post-print may be available for comment. The bar for peer review is raised by having preapproval by the editor, verifying that the article is relevant, and a public peer review with the article published as discussion papers open to interactive and viewable comments from the referees and the community.[145]

There are new sources that present an opportunity to use alternative metrics to citation-based ones: how many times an article has been bookmarked, blogged about, quoted, and so on.[146] Altmetric data come from many sources and take many different forms. Further, they can also refer to metrics on alternative research products, such as presentation videos, data sets, and software.[147]

The need to find alternative indicators of research production that capture a larger portion of the outputs is especially claimed by developing regions. In fact, while in those countries a significant portion of research-related activities is disseminated outside the system of peer-reviewed journals, there is little systematization of this information and few indicators to track its growth, use, or impact. Therefore, future work should focus on indicators of OA scholarly works published both in academic journals and repositories. Latin America may be a cornerstone. Indeed, comparing scholarly communication strategy in developing regions, Latin America has become a model for the adoption of OA in communications in the last few decades. This has led to the development of several regional initiatives all working to increase access to research published in Latin America.[148] Data connected to OA publications could complement the traditional indicators, which poorly represent developing regions, with ones that are better suited to the realities and needs of developing regions.

Piwowar, for example, specifies at least three possible strengths of altmetrics.[149] The first deals with a more nuanced understanding of impact showing which scholarly products are read, discussed, saved, and recommended as well as quoted. Second, more timely data could be available. Third, there could be more

[144]For a discussion of the so-called open peer review or peer-to-peer review, see Fitzpatrick and Santo (2012).

[145]Armbruster (2005). About models that entail post-publication peer review, see Shirky (2008).

[146]Piwowar points out the potential advantages that are especially relevant in the context of OA indicators for developing regions. See Pinowar (2013).

[147]In the last few years the field of altmetrics has received a lot of attention. See e.g. Bailey (Bailey 2013). PLOS has a special altmetrics collection available at http://www.ploscollections.org/article/browseIssue.action?issue=info:doi/10.1371/issue.pcol.v02.i19. The American Society for Information Science and Technology published a special altmetrics issue available at https://asis.org/Bulletin/Apr-13/AprMay13_Konkiel_Scherer.html.

[148]See Alperin et al. (2014).

[149]See Piwowar (2013).

information on the impacts on diverse audiences including not only scholars, but also practitioners, educators, and the general public.

Finally, creating alternative tools for evaluating research is a necessity also from the point of view of the incentive to publish in OA.

4.1 Legal Policies Fostering OA

OA represents a collateral solution to the traditional publishing channels that are indeed still dominant. Recent empirical studies have shown that proper recognition of OA (even the green road) is slowing down and its implementation varies by country and discipline, sometimes encountering obstacles within the scientific community itself.[150] Of course, one of the difficulties in growing OA can be found in the hostility from traditional publishers towards fully recognizing the OA paradigm. They contrast OA in different ways, including by adapting contracts to changes and tensions of scientific communities in a way that secures their "old" business models, actually directing the choices of authors.[151]

The best prospect for change probably lies in ethical rules and social norms through a bottom-up approach.[152] However, a top-down system may also play a key role in addressing cultural and social changes towards a broad dissemination of and access to research outputs. Among these, institutional policies adopted by many research and funding bodies in accordance with organizational and regulatory choices are crucial in promoting OA.

Various options have emerged, and *prima facie* they can be grouped into two main categories: voluntary and mandatory policies.[153] The choice between them could be influenced by the aim to preserve academic freedom of researchers: mandatory regulation imposing obligations on authors regarding the right to freely choose whether, where, how, and when to publish the research outcomes restricts the freedom of academic authors.[154] As a matter of fact, most of the policies adopted by universities and research institutions in Europe are voluntary, providing

[150]Some researches show that proper recognition of full Open Access journals by the community remains a major obstacle to overcome if they are to become a viable alternative to scholarly communication. As in other social contexts that rely more on collective action and reciprocal recognition than on a top-down structure, social norms tend to prevail over laws because they seem better able to regulate social interactions. This is underlined by a wealth of literature. Furthermore, though we generally think of academics as a unified group, their social norms are actually localized and vary across disciplines and national boundaries. See Migheli and Ramello (2014), Migheli and Ramello (2013), pp. 149–167, Björk (2004), p. 1; Eger et al. (2013).

[151]See Kaufman (2008). More generally, see Albert (2006), p. 253, Stevenson (2010).

[152]See Lametti (2010), p. 309, Geiger (2013).

[153]Suber (2012).

[154]With regard to the German legal system, see Lutz (2012), Krujatz (2012), Steinhauer (2010). For the US, see Priest (2012). For Italy, see Caso (2013). As for Spain see, de Roman Perez (2012).

for incentive mechanisms to encourage faculties to publish or re-publish in OA or, at least, to deposit the published work in a repository (referred to as "dark deposit").

Some policies require storage in the institutional repository of all works accepted for publication, while public access to works is only allowed after the university is granted a license by the right holder. This is the case of the University of Liège in Belgium.[155] The deposit guarantees the preservation of research products, indexing them and making the bibliography available to the public. The strength of this regulation is the incentive approach that is based on the evaluation procedures of curricula: for this purpose, only works deposited in the institutional archive are taken into account.

Furthermore, both the US model and some European governments have taken steps towards proper recognition of the OA principle (i.e. Spain,[156] Italy,[157] and Germany[158]). Among developing countries, Argentina, Mexico, and Peru have recently issued acts aimed at regulating the subject.[159] We will now briefly consider a few legislative models, in particular the US one, and the Italian, Spanish and German systems. Among the developing countries, the ambitious Argentine law is worth some attention.

First was the US legislature. The US system offers much food for thought. One reason for this can be found in its tradition of encouraging private licensing in industry while at the same time some major US universities, such as Harvard and the Massachusetts Institute of Technology, strongly support the OA principle through institutional regulations. This proves that research results can be appreciated in two different ways: through economic exploitation by patent licensing and OA to publishing. As for the latter, the US government in 2008 strongly promoted OA by stipulating, first in the biomedicine sector, that "all articles arising from the National Institutes of Health (NIH) funds must be submitted to PubMed Central upon acceptance for publication."[160] The law[161] safeguards free access to the public, requiring all beneficiaries of public funding to republish the peer-reviewed version on PubMed Central no later than 12 months from the first publication. The fulfillment of this obligation was subject to implementation by the publicly funded entity of a policy aimed at managing copyright issues between authors and publishers.[162] The governmental promotion of OA in the US has been progressing steadily, despite debates and the reactions from publishers who have challenged the

[155]See http://orbi.ulg.ac.be/.

[156]Artículo 37 (Difusión en acceso abierto), Ley 14/2011, de 1 de junio, de la Ciencia, la Tecnología y la Innovación.

[157]§ 4, Law October 7 2013, no. 112.

[158]Law October 1 2013 (BGBl. I S. 3714).

[159]Marzetti (2013).

[160]See the "Revised Policy on Enhancing Public Access to Archived Publications Resulting from NIH-Funded Research" at http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-033.html.

[161]Division G., Title II, Sect. 218 of PL 110–161 (Consolidated Appropriations Act, 2008).

[162]Carroll (2008).

mandate policy.[163] On January 18 2014, the US government adopted the Consolidated Appropriations Act 2014. Section 527 of the Act requires publicly funded research from grants made by US government agencies with a funding turnaround of more than $100 million annually to be available online in OA within 12 months of publication in a peer-reviewed journal. The Act calls for open licensing, common deposit procedures among agencies, and formats that support re-use and additional uses such as computational analysis.[164] While the federal regulation strengthens the green road of OA by extending the mandate of the success achieved by the NIH to all research financed by all agencies of the federal government, OA policies are also arising at the state level.[165]

European countries, on the other hand, have been urged to take specific and clear measures to support OA. Since 2006, the European Commission has taken some important steps towards ensuring access to publications and scientific data (referred to as open data). The EU Commission applies this intervention to its own research programs as well (i.e. FP7 and Horizon 2020) and encourages Member States to take measures aimed at promoting both open access and open data.[166] This approach has resulted in the EU Communication "Towards better access to scientific information: Boosting the benefits of public investments in research," COM (2012) 401, and the Commission Recommendation on "Access to and preservation of scientific information" (2012/417/UE) of July 17 2012.

The European approach promotes a multilayer system involving all lawmakers, including states, funding bodies, and research entities that manage public funds. The regulation details are to be defined by the subjects that are more familiar with each specific scientific reality.

Within the European framework, the Spanish legislature came first issuing *artículo 37* (*Difusión en acceso abierto*) of *Ley 14/2011, de 1 de junio, de la Ciencia, la Tecnología y la Innovación.*[167] The law is aimed at republication in open archives. The scope of the rule is limited to serial or periodical publications. It requires staff involved in research that is more than 50 % state-funded to publish as soon as possible, and at any rate no more than 12 months after the first publication, the final version accepted for publication in an open-access disciplinary or institutional repository. It is worth mentioning the provision that makes the version of the scientific contribution republished in open-access repositories available for consideration in the evaluation procedures of public administration. The most critical passage

[163]See Snyder (2009), p. 127.

[164]See White House Office of Science and Technology, Memorandum for the Heads of Executives Departments and Agencies, Increasing Access to the Results of Federally funded Scientific Research (23 February 2013) http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf. See also Suber (2013).

[165]The California Taxpayer Access to Publicly Funded Research Legislation (AB 609). See more at http://www.sparc.arl.org/advocacy/state/ab609#sthash.bi9lAuau.dpuf.

[166]See Guibault (2013).

[167]http://www.boe.es/diario_boe/txt.php?id=BOE-A-2011-9617.

is at the very end, where it specifies that the provisions of the law do not override agreements aimed at transferring to third parties the rights to the publications.[168]

A similar approach was adopted by the Italian legislature that issued an Act concerning the appreciation and promotion of culture (Law of October 7, 2013, n. 112, G.U. n. 236, 8.10.2013). With the new statute, the parliament is seeking to bring Italian law in line with the aforementioned EU Recommendation, addressing all the subjects involved that shall "implement the necessary measures for the promotion of Open Access" with regard to works publicly financed (at least 50 %) and published in periodical collections (at least biannually). The Law requires the research institutions to adopt policies that promote OA by following both the gold road and the green road. As for the latter, the Italian statute encourages republishing articles for noncommercial purposes in institutional or disciplinary repositories (so that they can be accessed free of charge from a place and at a time individually chosen by the user) no later than 18 months from the first publication for scientific, technical, and medical disciplines and no later than 24 months for humanities and social sciences.

While one positive aspect of the Act is to recognize and encourage the application of OA, it presents some shortcomings as well. First, the law uses several terms without defining them, even though these terms may be ascribed different meanings. One example is the notion of OA, which is defined neither in the Act nor elsewhere. Second, the new Italian law does not at all address the issue of IP rights management. Consequently, the authors may assign or license their copyright and then will not likely be able to republish in OA. It is up to research institutes to adopt policies for implementing OA while also guiding authors in managing their rights.

A further benchmark in the European context is the German model and, more particularly, the Law of October 1 2013, amending Section 38 of the German Copyright Act (Urheberrechtsgesetz—UrhG) which aims to remove one of the main obstacles to OA, i.e. loss of the right to republish the work as a consequence of assigning the copyright to the publisher. The new law allows the author of a scientific work,[169] published in a periodical collection (at least biannually) and created in the context of a research activity that "was at least 50 % publicly funded", to make his work publicly available for noncommercial purposes 12 months after the publication. The provision is mandatory, and any derogatory agreement is invalid. Therefore this right persists even if the author has assigned all exclusive rights to an editor or publisher. The law presents a number of complexities with regards to its scope, and in terms of private international law it suffers from the intrinsic limitation of being a national law. This is a complex question that cannot be discussed here.[170]

[168]See, de Roman Perez (2012).

[169]The scope of this expression has still not been clarified by the legislature. According to some first comments, "scientific work" includes not only written works but also technical projects, designs, tables, three-dimensional models, etc. See Wandtke and Bullinger (2014), pp. 15–25.

[170]See von Lewinski and Thum (2011).

Looking outside of Europe, the Argentine model deserves particular attention. The Argentine public sector is making progress down the legislative path to drive open ideas, becoming a regional pioneer in this matter. Argentina issued a law specifically devoted to the subject—Ley 26.899 "Creación de Repositorios Digitales Institucionales de Acceso Abierto, Propios o Compartidos" on November 13 2013.[171] The law requires organizations and institutions that make up the *Sistema Nacional de Ciencia, Tecnología e Innovación* (SNCTI) and receive state funding, to provide open-access repositories for depositing scientific production. The free and open-access institutional digital repositories should be compatible with international interoperability standards, and ensure free open access to the documents and research data (Article 4). The notion of scientific production is broadly defined as the product of scientific activities that are financed in whole or in part with public funds. The same parties are required to create policies for public access to and management and long-term conservation of the primary research data. Government agencies and national organizations of the SNCTI are obligated to insert in their financing instruments contractual clauses that govern management plans for primary data as well as plans for ensuring public availability of the research results.

Research staff (in the broader sense, including researchers, technologists, professors, postdoctoral fellows, graduate and PhD students) is required to deposit or to authorize the deposit of the final published version, or accepted for publication, of the scientific-technological products in open-access institutional repositories. They must be deposited within six months of publication or acceptance. Also, institutions are required to deposit primary research data in their own repositories or in those shared with other institutions within five months of collection, in accordance with the relevant institutional policies. The only exceptions to the deposit obligation arise in the event that the products and primary data are industrial property or secret.

In cases in which scientific and technological publications and primary research data are protected by intellectual property rights or by private agreements with third parties, the authors must provide and allow public access to the metadata of such publications and primary research data, agreeing to provide full access to the publications and primary research data from the expiration date of the intellectual property rights or private agreements with third parties (Article 6).

The law also establishes penalties for non-compliance, and the Ministry of Science, Technology and Innovation is the enforcement authority (Article 7). Failure to comply with the Act's provisions will make the breaching institutions and individuals ineligible for public financial support (Article 8).

The law is complex and dense with concepts as well as obligations. Only time and concrete measures for implementation will determine whether the law has had any impact. What is certainly striking about this model is the overall vision and ambition of the Argentine legislator; for the law sees a close connection between the rules regarding products and those relating to primary data.

[171] http://repositorios.mincyt.gob.ar/recursos.php.

5 Research Findings Dissemination Within International Law

The right to freely develop and express scientific thought according to academic freedom implies the possibility of both publishing and accessing the results of scientific research. The OA approach, granting access to all academic works without legal, technological, and economic barriers, thus reflects the principles of community science described above. At the same time, however, OA as it is currently applied is not without its issues.

The gold road of OA deals with a paradigm shift. Everyone would have the right to access and, according to Libre OA, to use the scientific content of any published article. Copyright owners would invoke copyright as a tool not for restricting access to the material they publish but rather for ensuring permanent OA through open licensing. Along these lines, scientific publishers would provide a service for which they would be paid *ex ante* (by authors or research institutions). This is a crucial matter. If copyright were to remain in the hands of authors, they themselves would be able to grant the public free access to their content. Otherwise, there is the risk of having to pay publishers for a service and at the same time handing over patrimonial rights to them. In this context it is worth pointing out that in the UK some early issues have been raised on the costs of OA, as applied by publishers. University expenses for article processing charges (APC) to make their academics' publications freely available in fully open-access journals, or in journals that offer an open-access option, are extremely high. Moreover, universities face other challenges in making their articles open access. Although universities pay to make an article free, what might happen is that on initial publication the article is still closed-access, with a statement to the effect that the publishers own the copyright.[172]

On the other hand, in the current transitional scenario, especially considering the predominant research evaluation system in place and the relatively small number of high-impact OA journals, the green road may allow authors to embrace the traditional publishing channels while also making their works available in OA. This represents a first step towards granting general access to scientific content, improving the preservation of works and the development of content databases, as well as promoting a variety of new research evaluation criteria and value-added services. [173] In addition, technologies based on data mining and the semantic web might support the creation of an infrastructure that would encourage authors to spontaneously enrich repositories, thus triggering a virtuous circle in the OA paradigm success. The results that OA will produce in terms of research evaluation

[172]Jisc Collections is still collecting data from institutions, encouraging them to submit in a standard form that it provides. See more at https://www.researchprofessional.com/0/rr/news/uk/open-access/2015/2/22-universities-spent–9m-on-open-access-in-2014–reveals-Jisc-data.html#sthash.2SDGRLFu.dpuf.

[173]On the importance of having several works published in OA so developing further OA publications, see Harnad (2010), Harnad (2013), (2014), Houghton and Swan (2013).

improvements and value added for authors and users will be crucial in determining its success. However, the implementation of the green road involves costs for setting up and managing institutional repositories that add to the current costs of purchasing the journals.[174] These are still a fundamental access point to scientific publications.

So legislatures and research institutions are currently faced with the challenge of how to promote access to scientific publications while respecting the balance between the various interests at stake. The solutions that have emerged until now and on which OA is based essentially revolve around contracts. However, on their own, contracts seem insufficient; for what is at play here are the negotiational will power and strength of the parties involved (authors and publishers, in particular). So some legislators, as outlined above, have acted more or less effectively in favor of OA and of the green road in particular. The regulations issued until now, apart from the Argentine law, tend to incentivize OA publication, rather than requiring it.[175] Starting from the assumption that obligations end up limiting academic freedom, any provision that leads to a mandatory OA publication or re-publication following both the gold and green road may raise doubts of legitimacy.[176]

Embracing a plurality of distribution channels of scientific knowledge as well as of methods of evaluation of scientific research appears to be the right approach to promoting respect for fundamental rights. Guaranteeing this plurality helps avoid monopolies or oligopolies in the management of information while cutting out unjustified costs.

Particular attention on that issue is to be paid within the current knowledge environment where access to the enormous amount of data and literature could theoretically strengthen scientific methodology, the norms of the "Republic of Science".[177]

This issues needs to be approached organically, starting from the cause rather than the effect. Identifying current barriers to free circulation of scientific publications is the first necessary step. Removing them would help create the right incentives for all players involved.[178] Indeed, while accessing, sharing, and reusing knowledge are at the heart of scientific methods granting academic freedom, currently wrong or missing incentives are in place, making scientists disregard these essential values.

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[174]See Kuhlen and Dewatripont (2006).

[175]The path of incentives does indeed seem to be easier. Besides, in academia there is doubt whether an obligation to publish in OA is legitimate and respectful of academic freedom. With regard to the German legal system, see Lutz (2012), Krujatz (2012), Steinhauer (2010). On the US contest, see Priest (2012). For the Italian one, see Caso (2013).

[176]See, de Roman Perez (2012).

[177]See Polany (1967).

[178]Dreyfuss (2014). According to the author, "More attention needs to be paid to the impact of intellectual property rights on human rights, culture, and development […] intellectual property rights are traditionally justified as a mechanism for generating incentives to innovate".

One of the obstacles to the flow of scientific knowledge, as seen above, is copyright management, which is bounded with the individual behavior whereby scientists aim to earn personal returns when publishing in high-impact journals.

Against this framework a holistic approach should be taken. Legal tools including copyright, contract law, and the research evaluation system need to be set up intelligently so as to encourage authors to pursue the needs of science. Besides, adequate technological tools (such as interoperable standards and repositories) and competent organizations, which are specifically devoted to university knowledge transfer, are a necessary prerequisite for promoting scientific knowledge.

While it is not only IP legislation that is at issue,[179] IP currently does play a pivotal role in academic knowledge governance. This is clearly a global issue. IP law within TRIPS does not yet incorporate a distinction between commercial and scientific knowledge. Although there is a kind of recognition that scientific works have something different from IP (e.g. copyright exception for scientific purposes), a proper understanding of IP rights in the university campus is missing. From this perspective, both international and national legislation reveals that policymakers have never seriously addressed the underlying question of how appropriately to protect cumulative and sequential innovation in science. Indeed, recent developments on the intellectual property front, first at an international level, include whole claims about extending monopoly positions and market power to leading firms, thereby protecting them from competition.[180] The TRIPS Agreement neither contains any direct reference to transfer of technology and knowledge,[181] nor deals with the interaction between intellectual property and publicly funded research for crafting developing strategies. The issue of access to the results of publicly funded R&D may be considered, with the aim of preventing restrictions on its transfer to developing countries, especially for research purposes.[182]

Despite the lack of specific measures in international agreements, individual States can play an important role in this direction. This is especially true for developing countries that need distinctive developmental strategies granting as much access to knowledge as possible.[183] The TRIPS Agreement leaves policy space to national legislators and judicial authorities with regard to the implementation and administration of their IP systems. Therefore, states retain the discretion to adopt a copyright approach for science that best suits their social, cultural, and economic needs and priorities. While TRIPS prohibits discrimination as to the field of technology, it does not prevent states from treating different situations differently. Differentiation that serves to level the actual conditions across all fields of knowledge and technology production and dissemination is not discriminatory but

[179]Many studies highlight the need to take into consideration different aspects of a legal order and not only intellectual property with regard to knowledge transfer. See e.g. Burlamqui and Cimoli (2010).

[180]Deere (2011).

[181]This has been pointed out also by Correa (2005).

[182]See e.g. Barton (2003), Reichman and Uhlir (2003).

[183]Reichman (2009), Stiglitz (2005).

rather the opposite. It constitutes a necessary response to the diversity and, consequently, a *conditio sine qua non* for a balanced system of protection. Accordingly, if the main policy goal is diffusion of innovation and not protection of the innovator per se, a one-size-fits-all prescription seems ill-advised. Differentiation may relate to the requirements of copyrightable works, to the exclusion of subject matter from copyright, as well as to the scope of protection, etc. One kind of differentiation might deal with scholarly publishing. The abovementioned Article 7 of the Agreement explicitly reflects the concern about that matter. Article 7 indicates that IPRs should promote innovation and the dissemination and transfer of knowledge. Members should accordingly implement their obligations under the Agreement in a way that effectively contributes to those objectives. Understandably, developing countries have attached considerable interpretative importance to Article 7 (as well as to Article 8), as indicated in the Doha Declaration on the TRIPS Agreement.[184] Moreover, Article 8(1) recognizes that Members "adopt measures necessary to promote the public interest in sectors of vital importance to their socio-economic and technological development". Accordingly, "appropriate measures […] may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology".

Thus, while the room available within the TRIPS agreement to foster technology transfer is quite small, it seems necessary to identify ways of taking full advantage of the TRIPS flexibility. This flexibility is the background to the norms that tend to ascribe OA to scientific publications. The German copyright Act, in particular, as mentioned above, legislates on contractual discipline, to thwart practices that limit knowledge dissemination, making publishing knowledge publicly and freely available.

In keeping with the flexibility granted by TRIPS, one might imagine a discipline that tends to appreciate and promote the particular nature and characteristics of scientific publications in relation to the author's incentives and the fundamental rights at play. The specific nature of scientific publications is such as to allow a distinction from the point of view of protection compared to other works destined for the market.

A copyright law reform might deal with different aspects, such as broadening copyright exceptions in favor of access to knowledge, granting a republication right to the author, providing the publisher with a nonexclusive license while keeping copyright in the hands of the author, or providing the author with a compulsory license granting the right to republish in OA. However, given the nature of academic written work, according to a differentiation approach, we might imagine a paradigm shift in the protection of these works. As previously mentioned, research —at least publicly funded research—is remunerated ex ante. That means it may no longer be necessary to hold exclusive economic rights to the written academic

[184]See WTO, Doc. WT/MIN(01)/DEC/W/2 (14 Nov. 2001). Paragraph 5(a) of this declaration states that "In applying the customary rules of interpretation of public international law, each provision of the TRIPS Agreement as expressed, in particular, in its objectives and principles.".

works. In the academic field, while moral rights are a cornerstone, the creation of a market may not be desirable. Hence, a regulation that grants the academic author moral rights and not patrimonial rights in publications might be acceptable and not in conflict with the fundamental principles. In this perspective we might look at the work in its ontological dimension, considering it protectable as long as its market needs to be preserved. The concept of copyright-protected work could be defined by the reasons for such protection in the context of reference. Along these lines, in defining the concept of original or creative work, academic written works might be considered a special category. Particularly in the case of the products of scientific research to be published in journals or research books, the work is not destined for a market favoring authors and their independence, which needs to be protected from the various interests at stake. So, while to this day there is no original definition of work on an international or regional and national level,[185] in a functional copyright approach, a work might be defined as protectable when exclusive rights need to be created.

6 Conclusions

Technological and social innovation are tightly intertwined with scientific research. Access to research results is a reflection of basic values such as freedom of expression and academic freedom. Yet university commodification limits the accessibility and circulation of scientific finding. In fact, IP and the tools for promoting academic knowledge as they are currently applied do not take into account the distinctive characteristics of science. Little attention is paid to the issue of knowledge transfer in laws protecting IP, first and foremost in international law. Lawmakers focus on protecting works without making a clear project for fostering innovation. Consequently, no distinctions of category are made.

The production and dissemination of scientific knowledge, particularly with regard to academic publications, is a value in of itself that needs to be considered separately. Allowing access to and use of scientific publications is a goal of global public policy.

The OA movement in its different manifestations is a spontaneous response to this situation. In order to assert OA, some lawmakers have issued laws based mainly on incentives and only rarely on obligation. In most cases such laws have the programmatic aim of requesting OA regulation at an institutional level. They are mainly focused on the green path, which helps reasonably promote different publication channels. In most cases, however, they do not deal with issues connected with authors' management of copyright and have no bearing on the discipline of evaluating scientific research, which is indirectly governed by criteria established by private parties.

[185] Ohly (2014).

Laws aimed at favoring public access to and the free use of scientific publications and, ultimately, scientific knowledge transfer, are well justified and in accordance with the TRIPS agreements. While not directly focused on university knowledge dissemination, but rather on a strict and broad protection of IP, these agreements allow Member States enough flexibility to favor university KTT. In this area the legal policies of developing countries could be based on the circulation of scientific knowledge. History shows that countries like the United States that today push for maximum IP protection, actually founded their development on imitation and use of previous knowledge. Therefore, in the current scenario, developing countries could play a crucial role in establishing models for the circulation of scientific knowledge that take into account the distinctive characteristics of science while promoting the tools of communication that technology makes available.

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Innovation in Business Practices of Women Microentrepreneurs in Benin, Cameroon and Côte d'Ivoire

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Abstract

This chapter aims to contribute to the understanding of the relationship among law, and more specifically commercial law, development and innovation in low-income countries. It examines how this relationship unfolds in the female micro-entrepreneurial sector in Africa. Innovative business practices were investigated through semi-structured interviews in Benin, Cameroon and Côte d'Ivoire. Moreover, the chapter analyses some particularities of the OHADA regime in order to assess how they affect entrepreneurial innovation in the environments in which the respondents trade. The conclusion makes preliminary recommendations on the manner in which commercial law reform can help overcome the obstacles to female micro-entrepreneurial innovation.

1 Introduction

When it comes to investigating the relationship between law, innovation and development, several studies focus on only two of these three parameters. They either look at the impact of law on development,[1] at the interactions between law and innovation (e.g. de Beer et al. 2013), or at the dynamics between innovation and development (e.g. Napier 2010). Also, a significant part of the literature

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[1]For example, see Kessaris (2010), Trebilcock and Daniels (2008), Davis and Trebilcock (2008), Bunn (2006), Crook et al. (2007), Englund (2006), Bradlow (2005) and Kozolchyk (2007).

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concentrates on industrialised countries (e.g. Litan 2011). To that effect, two of the three editions of the Oslo Manual, a guide drawn up by the Organisation for Economic Cooperation and Development (OECD) to provide analytical frameworks for entrepreneurial innovation, deal with technological innovation of products and processes in Member States of the organisation (OECD 2005). With the exception of Mexico, these States are all considered high-income countries. Only the third and most recent edition of the manual initiates a reflection on the characteristics of innovation in developing countries.[2] However, the reflection is based on the Bogotá Manual published in 2001 by the Ibero-American Network on Indicators of Science and Technology,[3] which itself draws heavily on the first editions of the Oslo Manual.[4] Moreover, the Bogotá Manual aims at harmonising the technological innovation indicators used in the Caribbean and Latin America with international standards, which overlap with those of the Oslo Manual.

In view of the above, this chapter aims to contribute to the understanding of the relationship between law, and more specifically commercial law, development and innovation in low-income countries. It examines how this relationship unfolds in the female microentrepreneurial sector in Africa. Women-owned microenterprises in Africa are characterised *inter alia* by their microscopic size—they generally employ no more than three workers, which may be salaried or not, by a start-up capital based on personal savings of their founder and by a low rate of registration for tax or commercial purposes.[5] The choice to focus the analysis on commercial law, microenterprises, women and Africa is driven by a number of considerations. First, despite the growing number of summits, symposia and media reports on innovation in Africa,[6] scientific studies of how economic law interacts with innovation and development on the continent are rare. This is surprising given the high

[2]This reflection takes, however, only a few pages in the Annex to the Manual (OECD 2005). In addition to technological innovations, this edition also focuses on non-technological innovation.

[3]*Red Iberoamericana de Indicadores de Ciencia y Tecnología,* http://www.ricyt.org/. This network includes national agencies for science and technology of American States and the Iberian peninsula.

[4]RICYT (2001).

[5]These criteria are derived from the observations made by the author in the context of empirical research in Benin, Cameroon and Côte d'Ivoire between 2010 and 2013. See subsection 3.1 for the detailed analysis of the characteristics of African microenterprises and a summary review of the literature on the subject. Compare Buvinic and Furst-Nichols (2014) (at p. 9, the authors define SMEs as having between 5 and 19 employees); Spring (2009, p. 15) (Canadian research knowledge network) (African microenterprise: 1 to 3 employees and operating in the informal sector); Fafchamps (1994); European Commission, http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition/index_en.htm, visited on 18 February 2015 (European microenterprises have fewer than 10 employees and a turnover of less than EUR 2 million).

[6]For example, Innovation Summit of the Africa 2014 in Cape Verde, http://www.africainnovationsummit.com/index.php/fr/; BBC, 'My life is so much better now', 17 March 2015 (this report is part of a series of eight prepared under the theme 'Med in Africa' and aimed at exploring medical innovation in Africa); Open air, http://www.openair.org.za/, visited on 18 March 2015 (research project looks at how intellectual property regimes can facilitate innovation and collaboration in Africa).

number of legal and economic integration organisations in Africa devoted to the development of their Member States.[7] Among these, the Organisation for the Harmonisation of Business Law in Africa (OHADA), created in 1993, stands out given the scope of the reform of business law it pursues today in seventeen West and Central African States.[8] It is therefore a well suited example for a case study.

Although the OHADA is an innovative model for law reform in Africa, its capacity to promote development in its Member States has not to date been fully investigated. The same is true for its impact on entrepreneurial innovation. Admittedly, the World Bank's *Doing Business Report in the Member States of OHADA 2012* (IFC and the World Bank 2012) attempts a first assessment of the impact of OHADA laws on the different stages of the lifecycle of businesses operating in the region.[9] However, the relatively favourable conclusions that the Bank comes to in its report are too limited in scope to establish whether the OHADA regime effectively contributes to development in its Member States. Moreover, the report provides little information on the ability of OHADA law to promote innovative business practices, particularly for microenterprises operating in the region.[10] This is possibly because the OHADA itself still pays little attention to microenterprises, notwithstanding that they constitute a significant portion of African economic stakeholders. In sub-Saharan Africa 72 % of non-agricultural workers are employed in the sector commonly referred to as informal, i.e. a sector where business transactions and labor relations largely take place outside the boundaries of official laws (Schneider et al. 2010). The majority of those working in the informal sector operate or are employed by microentreprises. In fact, 72 % of the labour force in Africa is engaged in unofficial self-employment, in work for a family business or in subsistence farming (McKinsey Global Institute 2012, p. 3). Although the OHADA adopted provisions in 2011 intended to encourage microentrepreneurs to register their trade, at the time of writing they remained widely unknown by those they target and had only been complied with by a small number of businesses in Benin following the implementation of a World Bank financed

[7]Africa has eight regional economic communities (RECs) and four regional organisations for legal integration. The latter are: The Organisation for the Harmonisation of Business Law in Africa, the Inter-African Conference on insurance markets, the African Intellectual Property Organisation, the Inter-African Conference on Social Security. The vitality and the degree of influence of these organisations and of RECs vary considerably from one to another.

[8]The founder members are: Benin, Burkina Faso, Cameroon, Comoros, Cote d'Ivoire, Central African Republic, Republic of Congo, Gabon, Equatorial Guinea, Mali, Niger, Senegal, Chad and Togo. Guinea, Guinea Conakry and the Democratic Republic of Congo have respectively joined in 1996, 2000 and 2012. In all these countries the tradition of French civil law coexists with the pre-colonial roots of local law. In some cases (e.g. Cameroon) they are complemented by Islamic law or common law.

[9]See in particular the "Executive Summary" of IFC and the World Bank (2012).

[10]See Part 3.2 for more detailed criticism of the report.

pilot project.[11] Given these circumstances, their capacity to foster microentrepreneurial innovation is doubtful.[12]

As for the need to focus on female enterprises, this has already been demonstrated by various studies that show the positive impact of women on governance and the leading role they play in managing the family and the education of children (World Bank 2000, 2012). These factors, as is widely known, have a significant influence on the socio-economic development of a country. Furthermore, in sub-Saharan Africa, women work under precarious conditions more often than men. About 85 % of women employed in the sub-Saharan non-agricultural sector occupy a position that the International Labour Office (ILO) describes as 'vulnerable', against 70 % in the case of men.[13] Vulnerable employment is characterised by paid or unpaid labor as a family or independent worker and difficult working conditions. It is seldom officially declared. Similarly, the percentage of female workers employed in the non-agricultural informal sector in Sub-Saharan Africa is 84 % compared to 63 % for men (Schneider et al. 2010). This data shows the importance of examining how current business laws encourage or discourage inventiveness and access to new markets by women microentrepreneurs specifically. To improve the socio-economic situation of these women, a priority of the States and of organisations that seek to promote development through law reform should be to foster women entrepreneurs' innovative market practices and to equip them with the legal knowledge and tools necessary to overcome barriers to innovation in the environment in which they operate. This approach would facilitate the sustainable operation of female microenterprises in Africa and in so doing would promote the socio-economic development of their communities.

Considering the above, this chapter looks at the concept of innovation and seeks to identify the attributes that make it possible to qualify a business practice as innovative in the African context. It uses the definitions of innovation of the Oslo and Bogotá Manuals as a starting point and analyses their components in the particular context of microenterprises run by women in Benin, Cameroon and Côte d'Ivoire. These countries are among the fourteen founding States of the OHADA and each host one of the organisation's key institutions.[14] It can therefore be expected that the effects of the OHADA reform, if any, on development and innovation will be more concentrated and more easily observable in those States. In addition, the author conducted semi-structured interviews with 144 women

[11]See Part 3.2 for the analysis of some of the rules and their effectiveness.

[12]The limited interest of organisations like OHADA toward microenterprises as agents of development has its counterpart in the African and non-African States: see Thiam et al. (2012); Vivier (2013) (the author follows the traditional position in the West according to which the development of Africa requires investments and foreign firms).

[13]International Labour Office (2012, p. 42). The statistics are from 2011. See also United Nations (2014, p. 20 ff.).

[14]The Permanent Secretariat of the OHADA in Yaoundé, Cameroon, the Common Court of Justice and Arbitration in Abidjan, Côte d'Ivoire and the Regional School of the Judiciary in Porto-Novo, Benin.

microentrepreneurs in urban and semi-urban areas in these countries between 2011 and 2013. These investigations enabled her to collect data on the economic and socio-cultural profile of the respondents and on their business practices. The data obtained, as well as the results of exchanges with officials, lawyers and professors specialised in OHADA law, with journalists, accountants and male microentrepreneurs, inform the analysis undertaken here.

The second part of this chapter discusses some specificities of the context of the countries being examined as well as some of the typical characteristics of the microenterprises that operate within them. This is in order to assess how these elements influence innovation opportunities and types of innovation within the selected countries. Moreover, Part 2 analyses some particularities of the OHADA regime in order to determine how they affect entrepreneurial innovation in the environments in which the respondents trade. The conclusion makes preliminary recommendations on the manner in which commercial law reform can help overcome the obstacles to female microentrepreneurial innovation identified in Parts 2 and 3.

2 Microentrepreneurial Innovation in Benin, Cameroon and Côte d'Ivoire: Definition and Attributes

The analysis of the relationship between law, innovation and development in Benin, Côte d'Ivoire and Cameroon requires consideration of what constitutes innovation in these countries as well as the identification of criteria that can be used to determine whether a (micro) enterprise, its products, services or practices are innovative. As indicated in the introduction, most of the research on innovation deals with industrialised countries and the research in developing countries is still in its early stages. Nevertheless, both streams of research provide lessons relevant to the questions addressed in this chapter. In particular, the definition of innovation provided by the third edition of the Oslo Manual is a useful starting point. It takes into account the criteria used in the 2001 Bogotá Manual to identify innovation in developing countries and its broad scope allows adaptation to different contexts, including those of the countries studied here (Manual of Bogotá, pp. 29–31). It defines innovation as follows:

> An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations (OECD 2005, para 146).

The following sections analyse the elements of this definition that are most relevant to the identification of innovation by microentrepreneurs in Benin, Cameroon and Côte d'Ivoire. The shortcomings of the definition are also discussed and additional criteria are suggested in order to assess the interaction between law, innovation and development in the above-cited countries.

2.1 Improvements, Novelty and Context

As appears from the definition quoted above, innovation requires by its essence an element of novelty or improvement. In order to assess the novel or improved nature of a product, a process or a method one must refer to what exists. In this sense, innovation is a relative phenomenon. It cannot be judged in absolute terms and depends on the context—legal, economic, political, social, cultural and temporal—in which it takes place. Therefore, to explore entrepreneurial innovation and assess the extent to which the products, methods and practices of an undertaking are new or improved, one has to refer to the context in which it operates. In the present case, the author conducted field trips in Benin, Cameroon and Côte d'Ivoire over a 3 year period, which helped her appreciate the socio-economic, legal, political and cultural context in which women microentrepreneurs operate their business in those States. Part 3 of this chapter reviews some characteristics of these contexts in order to understand how they influence the capacity of those interviewed to innovate and the type of innovation they undertake.

If the innovative quality of a product, process or method depends on the context, it is equally dependent on the perspective of the innovator and of the external agent (public official, competitor, consumer, lawyer, researcher etc.) who considers the product, process or method. What is new for a person X is not necessarily so for a person Y and vice versa. It is therefore conceivable that for the interviewees, a practice or method created and used abroad, e.g. microconsignment developed in Latin America,[15] consists of an innovation. It is also conceivable that a lawyer practising OHADA law and rigidly applying black letter rules will find among women microentrepreneurs' commercial practices some that she would consider legal innovations. Therefore, in order to determine whether products, methods and practices of microentrepreneurs in Benin, Cameroon and Côte d'Ivoire are innovative or constitute improvements, two questions have to be answered. First, are these products, processes and methods new or do they constitute improvements from the point of view of the microentrepreneur who employs them? Second, are these products, processes and methods new or are they an improvement for consumers, competitors, foreign enterprises or the OHADA lawyer and legislator? Again, the empirical research and semi-structured interviews conducted by the author in Benin, Cameroon and Côte d'Ivoire with female microentrepreneurs, lawyers and officials enabled her to better assess the perspective and reference frameworks of the respondents. The following sections draw on this research to analyse the elements that drive innovation in the female microentrepreneurial sector in Benin, Côte d'Ivoire and Cameroon.

[15]'The microconsignment model', http://microconsignment.com/; Rosenberg (2011).

2.2 Products, Processes and Methods as Objects of Innovation

The Oslo Manual points to four elements as possible objects of entrepreneurial innovation: (i) a product—good or service, (ii) a process, (iii) a marketing method or (iv) an organisational method. These elements are not exclusive to enterprises operating in OECD countries. They can also be involved in the operations of African (micro-)enterprises. It is therefore relevant to analyse the characteristics these four elements may take in the African microentrepreneurial sector when considering innovation in female microbusinesses in Benin, Cameroon and Côte d'Ivoire. It is foreseeable that the products, processes and methods used by small traders in Africa will not have the same form and the same degree of complexity as those used by the typical enterprises that the Oslo Manual addresses to. This is because the Manual was first prepared using the frameworks of reference of OECD countries. It is therefore necessary to adapt the requirements set out by the Manual to conclude to the existence of an innovation to the specific context in which microenterprises operate in Africa.

2.2.1 Products

The definition of a "product" is simple: it is a good or a service. Therefore, in order to determine whether a good or a service provided by a microenterprise is innovative, one must examine its characteristics or intended uses. If these characteristics or uses display an element of novelty or improvement from the point of view of the entrepreneur, its competitors, consumers or other external observers, they constitute an innovation (OECD 2005, para 156).

Among the wide range of goods sold by the microentrepreneurs encountered, the most popular are the ones they qualify as "miscellaneous" (in French "les divers"), i.e. those necessary for daily life. They include a wide array of goods, from canned tomatoes to dried crayfish to soap, matches and bottled water.[16] Second come loincloths and garments of all brands.[17] Others sell suitcases and bags, school supplies, drinks (during holiday seasons only), oil, gas, agricultural products (mango, manioc, plantain, yam), fisheries (fresh fish) and farm products (hens), ready meals (fish, meat, rice, "aloco"), food cooked at home ("con cada"; sandwiches; lemon and hibiscus juice, ice cream, ice lollipops, yoghurt); accessories for hairdressing, clothing (new, end of series, second-hand, for adults and babies), shoes, hats, jewellery and other accessories for women, toys.

[16]The long list of "other business" sold by small businesses also includes the following products: Milk, fresh tomatoes, corn, rice, sugar, handkerchiefs, toothpicks; pasta; sardines, toilet paper, tomato paste, nougat, peanuts sticks; condiments, oils (palm, peanut), limes, couscous, palm wine, groundnuts, hygiene products, cakes, cigarettes, canned food, phone credit, cosmetics, toothpaste, eggs, sweetened beverages, caramels, mayonnaise, beans, cola nuts; sugar, sanitary towels, sponges, garlic, onions, salt, "gari", worms.

[17]E-target, Super Wax, Real Dutch Wax.

As for services offered, the most common are hairdressing, pedicure et manicure, sowing and catering in the street or in shack restaurants (called "cafeteria" or "maquis"). Gift packaging, accommodation, telephone services and housekeeping come second. Some stand out with their tourism services, business catering, and delivery services of office supplies to government agencies.

In sum, the products offered by the microentrepreneurs interviewed are not particularly innovative in the contexts where they are sold. In fact, in most places visited by the author, the market for several of these products appears to be saturated. Those who sell them refer to slump in sales as the main difficulty of their trade as well as to higher competition due to an increasing number of businesses engaged in similar trades. One of the few exceptions to this is the case of Odile, a seller of school supplies at Dantokpa market in Cotonou, Benin. She began to sell pump water to Muslim traders and customers wishing to pray during the day. She identified a demand for which in her corner of the enormous Dantokpa market there was no supply, and developed the market. Selling pump water is for Odile a means of slightly increasing her sales and allowed to position herself in a new sphere of activities. As she said:

> Ah, you know I am a trader and do not expect anything at the end of the month, I have to get along by myself. As people are next to me, they pray Allah, they cannot find water easily, and I am beside them, I am a dynamic woman. I do something to find money, so these are the ideas I got [author's translation].[18]

Shortly after she started selling pump water, a nearby trader engaged in the same activity. When asked how she reacted to the arrival of a competitor, Odile simply replied: "Ah, it is the market, what are you going to say, this is the market" [author's translation].[19]

One can wonder why women entrepreneurs in Côte d'Ivoire, Benin and Cameroon engage in sluggish trade or in what seem to be saturated markets. Answers this question can be found in the analysis of the socio-economic, cultural and legal context in which microenterprises carry out their trade in the countries being studied, as well as in the characteristics of such enterprises (see Part 3).

2.2.2 Processes

According to the Oslo Manual, a 'process' is a method of production—that is, a technique, equipment or software used to produce goods and to supply services—or a method of distribution—that is techniques, equipment and software used for procurement. Process innovation involves the adoption of a new production or distribution method or a method appreciably improved thanks to a (significant) change in techniques, equipment and software, if any, of the enterprise. In principle, the aim of process innovation is to reduce the costs of production or distribution, to increase the quality of supplied goods and services or to enable the production or distribution of new or improved products. The mere objective of saving costs or of

[18]Translated by the Author from the Interview with Odile, Cotonou, Benin 2012.

[19]Interview with Odile, Cotonou 2012.

improving the quality of supplied goods and services is not sufficient to qualify a new or improved process as innovative. The implementation of the process must result from the use of new or improved techniques, knowledge or software. For example, the adoption of new techniques, equipment and software to improve the management of a business with regard to its procurement and accounting methods is a process innovation. Similarly, the use of new or improved techniques, equipment (and software) for the development and supply of services consists of a process innovation.

Several sellers of loincloths and end-of-series clothing whom the author interviewed in the markets of Cotonou, Douala and Abidjan purchase their products in China rather than in the Netherlands (loincloths) and Europe (end-of-series clothing) due to the lower cost of Chinese products. To see an innovation in this change of procurement channels, the method used by these women to buy and distribute Chinese products would have to entail the adoption of new techniques or equipment. This method of distribution would also have to be new both in the West African context and for those sellers themselves, or for external observers. Data collected by the author is not conclusive in this respect and further investigation is therefore required on the matter. Notwithstanding, it shows other examples of process innovation among the microentrepreneurs encountered.

One such telling example is that of Gabrielle, a trader in Maroua, in the far North region of Cameroon.[20] She started a business that specialises in the drying and processing into powder of fresh foods such as tomatoes, onion, ginger, pimento and mango. She also launched a catering service. In both cases, the processes used by Gabrielle are innovative in the region—artisanal drying of food was at the time of conducting the interviews still infrequent in the Far North of Cameroon, as was catering. Thanks to these new processes, Gabrielle developed, not without difficulty as is explained below, niche products.

Another example of process innovation observed by the author is the use by Julia, seller of 'healthy' foods in Abidjan, of micro-credit as a source of start-up capital. Micro-credit is not a new financing technique from the perspective of external observers. However, it was new for Julia, who showed creativity and determination in using it in a context where micro-traders, including many of the ones encountered by the author, often hesitate to avail themselves of it or contemplate it with a certain amount of suspicion.

2.2.3 Marketing Methods

The third element that the Oslo Manual points to as being a possible object of entrepreneurial innovation is a business' marketing methods (OECD 2005, para 169 et seq.). Innovation in this regard requires a (significant) change in the design, placement, promotion or pricing of a good or service. Change in the design of a product relates to its shape, aspect and more generally to its external characteristics (appearance, packaging, taste, etc.), excluding its use or intended use. Change in

[20]Interview with Gabrielle (pseudonym), Maroua, Cameroon, 2012.

product placement affects the methods of sale of the goods (franchising, exclusive sales, etc.). Innovation in promotion involves the use of a concept for the first time or a new idea to increase the value of a product. Finally, innovation in pricing involves the use of new methods for varying the price (e.g. price reduction according to demand, time of day, etc.).

One respondent whose enterprise best illustrates microentrepreneurial innovation in the marketing of products is Julia, whose case was alluded to above.[21] Julia opened a micro-boutique of fruits and fresh yoghurt kept in a refrigerator and of 'healthy' dishes and fresh juice prepared on site in the relatively affluent Cocody district of Abidjan. Whereas the apples and grapes sold by Julia are essentially the same as those one can find in the large working-class market of Adjamé, the method of conservation of her products and their packaging are marketed as more hygienic, which explains their higher price.

According to the Oslo Manual, to be innovative marketing methods must be part of a business' overarching marketing strategy and must break with the methods previously used. They may be developed within the innovating enterprise or imported from another enterprise and can be used with respect to both new and existing products. In general, entrepreneurs adopt a new marketing method either to (i) better satisfy the needs of consumers; (ii) reach new markets; or (iii) increase sales by positioning a product in a new way. For Julia, the start of a new trade was prompted by her desire to develop a new market and to position herself in that market.

2.2.4 Methods of Organisation

The last element that the Oslo Manual refers to as one of the possible objects of innovation concerns the methods of organisation of an enterprise. These methods consist of a business' practices when conducting its activities and in its employment relationships (e.g. in terms of sharing knowledge), its techniques for the organisation of workplaces, for sharing responsibilities and decision-making, and the methods it uses for managing its external relations (e.g. relations with other firms or the public sector for collaboration or for searching new customers).

African women microentrepreneurs, including the ones whom the author met in the course of her investigations, display creativity and inventiveness when organising their activities and their workplace. Thus, contrary to public sector jobs and larger companies where remuneration consists of a fixed and regularly recurrent salary, microentrepreneurial labor arrangements take many forms, some of which are more similar to mutual aid than to salaried employment. For example, it is common practice for neighbouring traders to ensure customer service on behalf of a trader who had to leave her stall because of family or commercial obligations (e.g. accompanying a customer to a warehouse of wholesale goods). It is also frequent that microentrepreneurs hire a close or remote family member under an essentially non-monetary arrangement: the business owner provides food and accommodation

[21]Interview with Julia (pseudonym), Abidjan, Côte d'Ivoire, 2012 and 2013.

to the family worker in return for the latter's services as vendor. If these arrangements are not innovative from the point of view of microentrepreneurs themselves because they are widespread in the microentrepreneurial sector, they may be novel for the lawyer or the legal official whose reference framework is the official law. Also, as will be discussed further, in order to adopt rules designed to facilitate microentrepreneurial trade, legislators and experts in business law could usefully draw inspiration from certain microentrepreneurial practices for the organisation of the activities and of workplaces, integrate in the law the ones that offer the greatest benefits for small traders and enact rules to limit or try to deter those that appear problematic.[22]

2.2.5 The Nature of the Change Necessary for Innovation

As mentioned above, the Oslo Manual provides that in order to qualify as an innovation, a process must result from a change in techniques, equipment and software of an enterprise. Similarly, to be innovative, the manual foresees that the marketing method must operate a clear break with past practices and also be derived from a change in the methods used. The Manual requires that the change in techniques, equipment, software and marketing methods be 'significant' . Although it does not define "significant change", the Manual contrasts it with "incremental change" and "minor incremental changes" (OECD 2005, para 124). On the other hand, research on innovation in developing countries, including the one carried out in the preparation of the Bogotá Manual, suggests that entrepreneurial innovation, particularly among micro, small and medium-sized enterprises, often results from a series of smaller incremental and adaptive changes in the products or methods of the enterprise rather than from radical changes made via individual and circumscribed projects.[23] The author observed a similar trend in the course of her investigation in Benin, Cameroon and Côte d'Ivoire. For example, it is only gradually that Odile, the seller of school supplies in Dantokpa market, tried to innovate by means of minor incremental changes in her marketing methods: she started selling her goods through street vending with a basket on her head. She then rented a small stall in the market with the savings earned through her street vending job. After some time, she engaged in wholesale trade, renting small warehouses not far from her retail desk to store the goods.

The fact that microentrepreneurial innovation takes place mainly through incremental change rather than through significant changes is mainly due to the generally larger capital input required to bring about significant changes, capital

[22]An example of problematic recruitment practice, now prohibited by law in Benin, is that of hiring "*vidomingons*", i.e. children often coming from the remote family of the trader that the parents entrust to him in order to ensure their accommodation and meals. In return, however, *vidomingons* work in very difficult conditions, do not go to school and their work is often associated with exploitation.

[23]Manual of Bogotá (2001), p. 29 and 40, see also p. 22 and 47 (criticizing the excessive emphasis put by authors like Schumpeter and Kaldo, as well as by the second edition of the Oslo Manual, on radical technical change to the detriment of incremental and diffuse changes, much more common and a distinctive trait of innovation taking place in the enterprises of developing countries).

which is not available to small and micro enterprises in Benin, Cameroon and Côte d'Ivoire. Similarly, significant change in process or method entails a greater risk than incremental change. Such a risk is too high to bear for many microentrepreneurs who engage, as will be shown in Part 3, in their trade by necessity: they would lose everything if the risk materialised. In light of this, it is the mere presence of a change—minor or major, radical or incremental—in processes or methods that this chapter considers as the essential element of microentrepreneurial innovation.

The identification of small scale changes is empirically challenging. Indeed, it is more difficult to observe and classify small diffuse changes than to identify radical changes in the methods and practices of an enterprise. One possible way to address this challenge is to seek specific data on the evolution over time of the activities of businesses that are likely to innovate by means of small incremental changes. In the case of the respondents, the semi-structured interviews and the field observation facilitated data collection in this respect, notably because of the time devoted to the meetings and the direct access to the respondents. Among the questions asked to assess the nature of the changes undertaken by the microentrepreneurs, one prompted the respondents to describe the evolution of their entrepreneurial activities since the earliest days, another to compare the state of their affairs over a period of one, two, three and five years and a third to indicate the causes of the changes they noted. The author also carried out follow-up interviews with some respondents 1 year after the first encounter.[24]

Both the Oslo Manual and the Bogotá Manual are silent as to the role of law on innovation and vice versa. This question is of paramount importance in order to explore the relationship between innovation, law and development. Two types of interactions can be envisaged in this respect. On one hand, a rule can be the object of innovation in a manner similar to a process, a product or a method. In this chapter, this is referred to as norm innovation. On the other hand, the legal rules may in turn encourage, deter or otherwise influence innovation. The following paragraphs deal with microentrepreneurial norms as the object of innovation. Part 3.2 examines the influence of norms—both statutory and unofficial—on innovation and microentrepreneurial business.

2.3 Norms as Objects of Innovation

For the purposes of this study, norm innovation relates to the rules that entrepreneurs develop or adopt within their trade. It is the entrepreneurs themselves who are the source of innovative rules. Rules emanating from other sources such as national laws or banking practices are not examined. These rules are not created by entrepreneurs and cannot therefore constitute entrepreneurial innovation. The microentrepreneurial rules that this chapter looks at are the ones that govern the operation of microenterprises, provided that they are created or developed by the microentrepreneurs

[24]Interviews with Odile and Lydia (pseudonym), Cotonou, 2011 and 2012.

themselves. Therefore, the rules governing the production and distribution of goods and services, those encompassing the marketing of products and those governing labour relations and other aspects of the organisation of the enterprise constitute objects of possible microentrepreneurial innovation in the same way as the products, processes and methods they are concerned with.

This being said, it is difficult to analyse norm innovation separately from process or method innovation. Indeed, the implementation of a process or method involves by its nature the adoption and application of rules and practices. It follows that all entrepreneurial norm innovations imply an innovation of the process or method to which the norm(s) relate. Conversely, it is conceivable that a product, a process or a method be innovative without the specific rules that regulate it being so. Finally, as is the case for product, process and method innovation, norm innovation involves the adoption of new or improved norms. The novel or improved character of the norm is appreciated from the point of view of the entrepreneur or the external observer—lawyer, official, competitor, etc. And it depends on the context in which the enterprise operates.

There are several examples of norm innovation within the practices of the microenterprises studied here. One of them consists of the rules that govern what is commonly called the *tontine* in Benin and Côte d'Ivoire and the *réunion* in Cameroon. Both are rotating savings and credit associations. Although statutory law does not directly regulate them, they are highly regulated by an internal procedure designed and adopted by their members. If the basic structure and functioning of *tontines* and *réunions* share common features, the specific rules that govern them are as diverse as the people who join such institutions and come from all backgrounds in Benin, Cameroon and Côte d'Ivoire.[25] They are largely used by women microentrepreneurs for various purposes, from savings to credit, to insurance and social security. Similarly, their structures and rules—explicit and implicit—develop and change depending on the needs and the dynamics between their members. Therefore, both the informal legal institutions of the *tontine* and the *réunion* and the rules governing them are examples of legal innovations from the point of view of the lawyer and the official who practice and apply statutory law. Their explicit and implicit rules also have the potential of being innovative from the perspective of members of such institutions in so far as they satisfy the condition of novelty or improvement.

Apart from the *tontine* and the *réunion*, the author found other examples of microentrepreneurial rule innovations. These include the rules regarding the organisation of work within the enterprise and the mutual help between market vendors mentioned above. In the area of dispute settlement, the respondents adopt practices specific to them. They are innovative in several respects, particularly from an outside perspective. For example, unlike the widespread trend in common law and civil law systems, the microentrepreneurs interviewed were extremely reluctant to litigate their disputes. Several of them indicated preferring to preserve relations

[25]For more details on *tontines* and similar associations in West Africa see in particular: Deschamps (2012) and Balkenhol and Gueye (1992).

rather than trying to recover an outstanding debt. Given this, the techniques they favour to recover their debts are awaiting, repeated requests, termination of the relationship with the insolvent debtor and social pressure.

It is of course the case that business practices, including microentrepreneurial ones, are codified or incorporated in statutory law. This is desirable as it may increase the effectiveness of statutory law and improve its capacity to foster development. However, in order to identify entrepreneurial norm innovation, it is necessary to place oneself in the locations where these rules are created and developed. In the cases under study, these are the markets and other places where women microentrepreneurs operate in Benin, Cameroon and Côte d'Ivoire. To this end, it is appropriate to examine the context in which women microentrepreneurs operate their business.

3 Elements of the Business Context of Microenterprises in Benin, Cameroon and Côte d'Ivoire

To assess the interaction between innovation, law and development in the female microentrepreneurial sector in Benin, Cameroon and Côte d'Ivoire, it is necessary to focus on the context in which women pursue their trade. The following sections identify some features that are common to the context of Benin, Cameroon and Côte d'Ivoire and that may influence innovation in these countries. They consider some of the microeconomic and socio-cultural characteristics of the environment in which women in Benin, Cameroon and Côte d'Ivoire manage their microenterprises as well as the commercial legal environment in these countries. It is obviously impossible to provide a comprehensive and real-time portrait of the economic, social and legal contexts in the countries studied, much less of the differences that exist between and within these countries. The goal is rather to outline the context in which the women microentrepreneurs encountered by the author carry on their business. The following sections are based on the inquiries made by the author on the ground between 2011 and 2013 and on secondary empirical research.

3.1 Context and Socio-economic Characteristics of Female Microenterprises in Benin, Cameroon and Côte d'Ivoire

First, Benin, Côte d'Ivoire and Cameroon can all be qualified as developing countries. They are low or middle-income countries[26] and rank low on the human

[26]World Bank, "Classification of Countries", http://donnees.banquemondiale.org/a-propos/classification-pays, visited on 6 January 2015. The World Bank classifies Côte d'Ivoire and Cameroon as lower middle-income economies (i.e., between $976 and $3855) and Benin as a low income economy ($975 or less).

development index.[27] This index measures life expectancy and the health of citizens of a State, the acquisition of knowledge by them and their standard of living. Also, the economy of the countries being investigated is characterised by a high concentration of enterprises whose activities are not registered with the tax authorities and other official registries.[28] For example, in Côte d'Ivoire, the rate of informal employment increased from 28.38 % in 1998 to 60.75 % in 2006.[29] Moreover, most enterprises in the informal sector in Benin, Cameroon and Côte d'Ivoire are individual enterprises or of a microscopic size, financed by their director's personal savings, by gifts or family inheritance.[30]

According to some, the high number of microenterprises in Benin, Côte d'Ivoire and Cameroon is a consequence of the decline of traditional forms of production and trade in the agricultural sector, mass migration from rural areas due to poverty and the inability of the private sector and the public administration to employ a growing poorly educated workforce.[31] Moreover, the low level of school education of the majority of the active population in these countries and the financial insecurity in which they live tend to induce people to engage in small trade, an economic activity that is accessible and flexible.[32] This is particularly true for women. A walk in the streets and markets of towns and villages in Benin, Cameroon and Côte d'Ivoire provides ample evidence of this. One can meet many women in their small shops or restaurants, behind their desk or other temporary installation or street vendors scrambling at intersections to sell groundnuts, fruits, or trinkets they bring on their head.

Among the 144 microenterprises visited by the author in Benin, Cameroon and Côte d'Ivoire, very few had permanent and salaried employees. The trend was generally towards individual work or unpaid aid of 1–2 people, often family members. Furthermore, the two sources of start-up capital most frequently cited by the microentrepreneurs encountered are their spouse and their small personal

[27]Benin ranks 165th worldwide in this index; Côte d'Ivoire 171th and Cameroon 152th (2013 data): UNDP, Human Development reports, Table 1: Human development index and its components, http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components, visited on 6 January 2015.

[28]Fafchamps (1994, p. 3 and footnote 1) (citing studies carried out in 1980 and 1990 documenting the rapid growth of the number of microenterprises in Sub-Saharan Africa during these decades, characterised in particular by the absence of official registration of their activities).

[29]http://cotedivoire.africadata.org/.

[30]West African Economic and Monetary Union 2003, p. 5, hereinafter 'UEMOA report'). Investigations were conducted in support of this report in the main urban areas of Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo. The average size of microenterprises listed in these surveys is 1,53 people.

[31]Letouzé (2002). See also Kauffmann (2005): According to the OECD, the microscopic size of most enterprises in Africa is explained by the private sector's recent development and by financial and legal obstacles to capital accumulation.

[32]UEMOA Report, p. 4 (indicating that 60 % of heads of informal production units—i.e. microenterprises—in the territories surveyed consider the microenterprise as one of the preferred methods for entering the labour market).

savings. The majority of them have a low level of formal education. For example, 94 % of Cameroonian respondents indicated that they had not completed primary or secondary education.[33] The main causes for this are the lack of financial resources of the parents, tradition, family pressure, marriage, pregnancy and school failure. Similarly, several of the women interviewed explained that they took up small trade not by choice or personal preference but rather because this was the path drawn for them by their mother, aunt or other parent[34] or because of pressure from a husband wanting his wife fully available to care for the children, close to home or pursuing a socially acceptable activity.[35]

Another common feature of microenterprises in Benin, Cameroon and Côte d'Ivoire is that they are predominantly subsistence enterprises, i.e. businesses whose primary purpose is to provide the necessary income for satisfying the basic needs of those who operate them.[36] With regard to this aspect, the majority of the respondents indicated that they allocated their often small returns either to their trade or to the satisfaction of basic family needs. One of the respondents, Marlene, a Cameroonian hairdresser-beautician, explained her situation with these words: "My concern was to gain a bit more money to help my siblings because I am the eldest. I have always been committed to gain something to help my mother, the children and others."[37] Another respondent, Élodie, a Beninese dressmaker, replied as follows when asked about the allocation of the benefits deriving from her trade "We eat with them; we pay electricity, my husband died, I am alone".[38]

Several hypotheses may be made with respect to the influence that the socio-economic characteristics of microenterprises in Benin, Cameroon and Côte d'Ivoire have on the capacity and the manner in which their directors innovate. One of them concerns the impact that subsistence trade may have on microentrepreneurial innovation. To this end, surveys suggest that exploiting a trade by necessity rather than by personal choice places the entrepreneur not in an entrepreneurship dynamic but rather in a logic of job creation.[39] In such circumstances, the desire to innovate ranks low on the agenda of the entrepreneur, who is most interested in exploiting a business that provides the necessary for living. The trend, which the author observed in several of the respondents, of selling products very similar to

[33]Out of 32 respondents, only two have a university degree, 19 reported having completed some years of secondary school without receiving the diploma and 11 indicated that they had not completed primary education.

[34]This is the case for the majority of respondents.

[35]For example, interviews with: Lydia (pseudonym), Cotonou, Benin, 2011; Géradine (pseudonym), Banganté, Cameroon, 2012.

[36]UEMOA Report, p. 5. See also Letouzé (2002) (defining the subsistence economy of Ivorian micro-enterprises as implying that "les maigres revenues générés par [celle-ci] sont automatiquement utilisées à des fins telles une meilleure alimentation, l'achat de vêtements ou, encore, l'envoi d'un support financier à la famille restée en zone rurale ou résidant à l'extérieur du pays").

[37]Interview with Marleine (pseudonym), Yaoundé, June 2012.

[38]Interview with Élodie (pseudonym), Cotonou, May 2012.

[39]UEMOA Report, p. 2.

those of their neighbours tends to confirm this hypothesis. Such is the case at Misebo market in Cotonou, Benin, where there is a high concentration of sellers of loincloths—both from Benin and from other countries. It can be argued that, rather than embarking in an unknown activity and risking failure, loincloth sellers follow a model that has, at least in appearance, proved its worth and ensures a minimum income. Similarly, a Cameroonian trader, Hélène, explained that she had chosen the sale of 'miscellaneous' rather than of dresses in the early stages of her trading activity notwithstanding that she preferred the latter because in case of need, she could always "borrow" products from her shop to feed the family.[40] In addition, the accessibility of "miscellaneous" products such as the ones referred to previously, which can be obtained through wholesalers, importers and neighbouring countries' markets, their relatively affordable prices and a relatively strong demand for such products explain why they are a preferred option for women who want to ensure a small income from their trade.

It can be argued that women whose tradition, family pressure or level of schooling are such that the operation of a small business is the only available option for earning a living are not in a situation that is favourable to innovation. Indeed, these elements affect women's flexibility and creativity. In fact, all of the sellers whom the author met in Dantokpa market in Cotonou, Benin suggested they acquired the skills necessary to carry out their activity through a relative or by themselves. Lydia explained that she had to fall back on the small trade of sweets after her husband instructed her to do so, refusing to allow her to continue to work as secretary given the taboos associated with this occupation in their environment.[41] Moreover, several of the respondents indicated that they did not intend to transfer their business and skills to their sons because market trading is, according to them, an activity reserved for women. These are indicators of the rigidity of the socio-cultural environment in which the microentrepreneurs in Benin, Cameroon and Côte d'Ivoire carry on their business. It is likely that this rigidity discourages initiative and innovation of microentrepreneurs in the countries studied. The excerpt below, taken from an interview between the author and Monique, a seller of loincloths in Cotonou, Benin, illustrates the above:

> How do you see the future of your trade here? Do you have projects for your shop? Do you want to continue, stop, change?
>
> Well, only time will tell because the only trade I know is garments. This is what I know well. If you want to enter another area, if you don't know you'll fail because you're not used to it and you don't make progress therefore you are likely to fail. What you know, it is what you do. That is why we work on this but it will change, one has to prey God that it will change, it is God who changes everything. Before it was not like that. You don't know what will happen but it is God who will change all. We trust in God, God changing the world so that we will sell as before.[42]

[40]Interview with Hélène (pseudonym), Abong Bang, Cameroon, 2011.

[41]Interview with Lydia (pseudonym), Cotonou, 2011.

[42]Interview with Monique, Cotonou, Benin, 2011.

As is clear from this quotation, the apprehension of failure that could result from a change in products, methods or processes, combined with limited professional and technical skills exercised a decisive influence on Monique's lack of desire to innovate. Furthermore, the respondents whose practices are the most innovative and conducted the most significant change to their products, processes or methods are the ones that have a university education or a training to develop specific entrepreneurial skills. For example, Gabrielle (sundried products, Maroua, Far North of Cameroon) and Julia ('healthy' foods, Abidjan, Côte d'Ivoire) both attended training provided by non-governmental bodies before starting their business.

Although a state of need and low levels of formal education affect many microentrepreneurs and have detrimental effects on their ability to innovate, the correlation between these realities and innovation is not entirely negative. In fact, they sometimes contribute to the development by microentrepreneurs of marketing methods, of organisational practices and of norms that are original and innovative. For example, in Benin, Cameroon and Côte d'Ivoire education and childcare still depend heavily on mothers and female members of the family. Thus, whether or not they are mothers, women microentrepreneurs are often called upon to go about family obligations concomitantly to their trade. The need to reconcile their family and trade obligations results in the development by these women of creative methods of work organisation such as the ones based on mutual assistance between neighbouring shops mentioned in Part 2.

3.2 The Legal Environment

Although the Oslo and Bogotá Manuals allude in general terms to the impact that legislation may have on innovation (OECD 2005, para 105, pp. 142–143; Manual of Bogotá 2001, p. 33), they do not refer to empirical data that illustrates this influence or provide an analytical framework for assessing it. This section sets the foundations for analysing the role of commercial law in promoting innovation and development in Benin, Cameroon and Côte d'Ivoire. It focuses on the relationship between OHADA law and female microentrepreneurial innovation in these countries. To this end, it first describes the main characteristics of the OHADA regime. It then examines some OHADA rules aimed specifically at microenterprises with a view of assessing whether and how they affect the capacity and type of innovation of women trading in Benin, Cameroon and Côte d'Ivoire.

The OHADA was created with a declared objective to modernise and unify the commercial law of its members, and markets itself as an innovative model for economic development in Africa.[43] Its regime is based on the enactment of uniform laws, named "Actes uniformes" or "Uniform Acts", which each govern a trade related topic: arbitration, general commercial law, commercial companies and groups of economic interest, accounting law, collaterals, recovery procedures, collective

[43]Treaty on the harmonisation of Business Law in Africa, 17 October 1993, OJ OHADA, p. 1 (online: www.ohada.com, 17 ratifications).

insolvency procedures and the transport of goods by road. These laws, sometimes qualified as supranational, are drafted at the regional level and apply directly in each of the OHADA State Parties once enacted.[44] In principle, once they are in force, the provisions of the Uniform Acts have the effect of repealing any and all national statutes or provisions thereof that contradict the former. Moreover, despite its name, the OHADA reform is not based on the adoption of model laws or on harmonisation of rules. It seeks to unify the business law across all its Member States.

The unification goal of OHADA originates in the organisation's objective to attract foreign investment. This is a priority for the OHADA, which perceives large companies and multinationals as the main agents of innovation and of private sector development in its Member States. That said, the rules that make up its uniform laws are largely modelled on those of the legal systems these companies originate from. Among them, France has played and continues to play a leading role in drafting Uniform Acts.[45] As a matter of fact, it is France that instigated the creation of the OHADA partly in response to French companies operating in Francophone sub-Saharan Africa requiring a solution to the problem of obsolete, cluttered and maladapted post-colonial laws.

Thus, originally, OHADA law was not designed with the interests of small and micro businesses in mind and rather sought to cater to the needs of foreign companies and multinationals. In fact, none of the Uniform Acts that were adopted upon the creation of the organisation contained provisions specifically relevant to the microentrepreneurial sector. It is after being faced with various problems of effectiveness of its laws at the end of the 2000's, that the OHADA started revising its Acts. In so doing, its objective was, *inter alia*, to better adapt them to the realities of local trade,[46] including microentrepreneurial trade.[47] With regard to the latter, the objective of the OHADA is to subject them to official law and "to lift people out of the informal sector".[48] To this end, it has laid down provisions in the 2010 revised Uniform Act on general commercial law that reduce the accounting obligations and the formalities for the registration of single-person businesses, therein referred to as "*entreprenants*" (Article 30 et seq.). It should be noted here that the OHADA's

[44]See Deschamps (2013, p. 122 et seq) (examining some possible effects of supranational OHADA law on development in the Member States).

[45]Still today, France together with organisations such as the World Bank, where several experts come from the traditions of common law and of industrialised countries, continue to have a decisive influence on the content of OHADA law.

[46]For example, the revised Uniform Act on collaterals now provides for a special procedure to protect the rights of the illiterate surety: Uniform Act on the organisation of collaterals, 15 December 2010 (entered into force on 16 May 2011), 22 OJ OHADA 1, online: www.ohada.org, Art. 14 (2).

[47]OHADA also adopted the Uniform Act on cooperative societies, which also aims to regulate the many local associations operating under a cooperative business model.

[48]This is the expression used by the Permanent Secretary of OHADA in an interview in June 2013 while discussing the legislative provisions adopted by his organisation and aimed at regulating microenterprises: Malick Ciss, "Afrique: Pr. Dorothé Cossi Sossa "There is a major need of communication and fiscal support in our countries", AllAfrica.com, 8 June 2013.

definition of *entreprenant* differs from that of microenterprise used in this chapter. Among other things, the "entreprenant" articles only target single-member businesses and independent workers—excluding microenterprises that employ salaried and non-salaried workers such as the ones studied here. Moreover, the definition of "entreprenant" relies on the criterion of the enterprise's turnover, which is not the case here.

The OHADA's objective to induce microenterprises to migrate into the formal legal system lies on the presupposition that this will enable the States to access the "dead capital" they hold and therefore increase their tax revenues.[49] Thus, it is not in the interest of promoting microentrepreneurial innovation that Uniform Acts were adopted, or their revision initiated. Moreover, the OHADA along with the governments of its Member States appear to perceive microenterprises not as agents of change but rather as subjects operating "non-legally" or 'extra-legally', which as a result contribute little or nothing to the economy and to development in their countries.

It is against this backdrop that the impact of OHADA law on development and microentrepreneurial innovation should be analysed. To this end, it can be assumed that a legal and regulatory environment favourable to entrepreneurial innovation has a positive effect on economic development. However, to measure the potential of OHADA law to promote (micro)entrepreneurial innovation, one must first appreciate the extent to which it facilitates, hinders or discourages the operation of microenterprises.

As mentioned in the introduction, there is little empirical research on the effectiveness of OHADA law and on its ability to promote business in the Member States. Even though the World Bank's report *Doing Business in Member States of OHADA 2012* (IFC and the World Bank: Washington 2012) stands out as an exception to this observation, the report only focuses on the "formal" sector and on the analysis of "regulations applicable to local enterprises of the formal sector" (p. 7). This being the case, it excludes de facto from its analysis the majority of local microenterprises of Member States (including Benin, Cameroon and Côte d'Ivoire), which, as was exposed earlier, operate mainly outside official law.

Moreover, the World Bank's report does not examine the real and effective application of the Uniform Acts, but focuses rather on analysing the "law of the books", that is the written text of the laws. For example, the report looks at the formalities, costs, time and capital needed to set up a business. However, its assessment of these parameters presumes that the information that the entrepreneurs will need to fulfil the required formalities is readily available and that the relations with the public servants responsible for the creation of enterprises are free from corruption. These assumptions do not reflect the reality in OHADA States, where the corruption index of public officials is particularly high.[50] In fact, during

[49]The use of 'dead capital' by the Peruvian economist Hernando de Soto (2000) refers to the assets of these small shops and illustrates this perception.

[50]Corruption Index referred to Benin, Côte d'Ivoire and Cameroon: Transparency International, http://www.transparency.org/country.

informal discussions in Benin in June 2010, the owner of *a local chain of supermarkets* told the author that she must regularly make "gifts" to officials in order to speed up the process of setting up her businesses. Finally, apart from scattered assertions of a general nature on the effect that certain types of legislation might have on the ability of small and medium enterprises to innovate, the report does not deal specifically with the possible impact on innovation of the rules it examines.

Given the scarcity of the information available on the ability of OHADA law to promote microentrepreneurial trade, the following paragraphs focus on the effect of the provisions on the *entreprenant* as a case study. To that end, the author's primary and secondary empirical investigation shows that, 4 years after the entry into force of these provisions, voluntary registrations as *entreprenant* could be counted on the fingers of one hand.[51] Also, among the 144 women entrepreneurs interviewed by the author between 2011 and 2013 in Benin, Cameroon and Côte d'Ivoire, none had registered as *entreprenant* or was aware of the possibility and procedures for doing so. Similarly, the public servants working for registries and whom the author met during her research in Yaoundé, Maroua and N'Gaoundéré (Cameroon) also indicated that they had not received any applications for registration as *entreprenant*.

To remedy the problem of non-application of the legal provisions on the *entreprenant*, some countries such as Benin, Burkina Faso and Mali have planned or started pilot projects aimed at encouraging pre-selected microenterprises to complete the formalities required to obtain the status of *entreprenant*.[52] At the time of writing, the real impact and usefulness of these pilot projects could not yet be assessed.[53]

In the event that the rules on the *entreprenant* were effectively implemented, a number of factors suggest that, as is the case for many other provisions of OHADA law, men microentrepreneurs would gain more benefit from these articles than women. This is due to a combination of elements. First, the illiteracy rate among women in sub-Saharan Africa far exceeds that of men. Notwithstanding, many of

[51]See also Pierre Etienne Kenfack, "The Contribution of Rules to the transition of economic agents from the informal to the formal sector: Inquiry on the effectiveness of the status of entreprenant in Cameroon", Presentation at the conference on "The Effectiveness of Economic Law in the OHADA Area", 20–21 November 2014, University of Luxembourg. In the course of his investigation, Prof. Kenfack stated that one trader had registered as *entreprenant* in Cameroon.

[52]In Benin, 200 merchants were recorded as undertaking since April 2014 within the pilot project: La Nation, "Lancement de la phase pilote du statut de l'entreprenariat au Bénin: Inciter les enterprises à migrer de l'informel vers le formel", 30 April 2014, aCotonou.com; Dia, Magueye, Benin—Competitiveness and Integrated Growth Opportunity Project (CIGOP): *P 104881—Implementation Status Results Report: Sequence 11* (Washington, DC, 2014), World Bank, online: http://documents.worldbank.org/curated/en/2014/10/20333621/benin-competitiveness-integrated-growth-opportunity-project-cigop-p104881-implementation-status-results-report-sequence-11, visited on 17 February 2015.

[53]The ongoing evaluation of the project of the International Finance Corporation and the World Bank indicates that the level of progress in Benin in 2014 was unsatisfactory, so much so for the level of implementation: *Benin—Competitiveness and Integrated Growth Opportunity Project (CIGOP): P 104881—Implementation Status Results Report: Sequence 11*, p. 1.

the rules applicable to the *entreprenant* implicitly require that the he/she be able to read and write. For example, Article 32 of the revised Act on general commercial law requires the entreprenant to keep an annual written register that would contain the details of purchases, methods of settlement and supporting documents. Even if one disregarded the widespread illiteracy of women microentrepreneurs, it is unrealistic to think that they would comply with such requirements taking into account the realities of their work.

In view of the above, it appears that OHADA law is too rigid and formalistic and is ill adapted to the realities and needs of microentrepreneurs. This is from the point of view of both the form and the content.

4 Conclusions

This chapter laid the ground for understanding the relation between commercial law, female microentrepreneurial trade, innovation and development in Benin, Cameroon and Côte d'Ivoire.

To do this, it began by analysing what innovation consists of in the context of the countries and types of enterprises considered. In this respect, reference was made to the criteria used by the third edition of the Oslo Manual to define innovation. These criteria refer to the adoption by an enterprise of products—goods or services—marketing methods, methods of organisation and processes that are new or improved. However, since the principles in the Oslo Manual are primarily conceived by reference to the context of OECD businesses, the criteria it uses must be adapted to account for the specific economic context and characteristics of microenterprises in the countries examined, which are low-income countries. One important adaptation concerns the nature of the change in products, processes or methods that needs to be observed in order to conclude to the existence of entrepreneurial innovation. Thus, unlike the Oslo Manual, which insists on the presence of a 'significant change' in the processes and methods of an enterprise before concluding that there is an innovation, the characteristics of microenterprises in Benin, Cameroon, Côte d'Ivoire as well as other developing countries are such that when they undergo changes with a view to innovating, these changes are mainly incremental and small scale. Therefore, the criterion of gradual change is more relevant to the analysis of microentrepreneurial innovation in Africa than that of significant change proposed by the Oslo Manual. It is used in this chapter, in parallel with the criteria of novelty and improvement in the products, processes and methods, to identify examples of innovations stemming from the practices of microentrepreneurs in Benin, Cameroon and Côte d'Ivoire. The examples identified suggest that while women microentrepreneurs innovate little with regards to the products they sell, they are creative and ingenious in the processes, marketing methods, methods of organisation and the rules that they adopt to manage their business.

Furthermore, with a view to analysing the relationship between law, development and innovation, it was essential to consider not only innovation in products, processes and methods of microenterprises but also in the norms they develop and that govern their business. Often, these norms are independent and distinct from official law. One of the most significant examples of women microentrepreneurial normative innovation reported in the Chapter concerns the rules governing the functioning of the *tontines* and *réunions*.

After analysing the criteria necessary to identify female microentrepreneurial innovation in Benin, Cameroon and Côte d'Ivoire, the Chapter examined the legal and economic context in which women microentrepreneurs operate. This was in order to assess how this context influences women's capacity to innovate and the methods they use to do so. As regards the socio-economic context, the low level of schooling and the state of necessity of many African women microentrepreneurs were identified as factors that can inhibit microentrepreneurial innovation. Yet, the author noted during her on-site investigations that the need to ensure their subsistence and that of their family gave several women entrepreneurs incentives to innovate in the management of their enterprise. Similarly, the accessibility, flexibility and the possibility offered by microenterprises to those operating them to generate a basic income to meet the essential needs of their families make them a privileged tool of socio-economic development (Dickerson 2005, pp. 1163–1165).

With regards to the legal context, the chapter examined the main characteristics of OHADA laws and sought to determine how they affect microentrepreneurial innovation. It found that the strong influence of French law and of the law of other industrialised countries in OHADA law, together with a limited attention paid to the interests of microenterprises in the Uniform Acts, make the commercial legal environment in Benin, Cameroon and Côte d'Ivoire unfavourable to the exploitation of microenterprises and *a fortiori* to microentrepreneurial innovation. This is due in part to OHADA law's rigidity, which is unfit to the microentrepreneurial reality.

To overcome the socio-economic and legal barriers to microentrepreneurial innovation in Benin, Cameroon and Côte d'Ivoire, multiple avenues are possible, including an increased harmonisation between OHADA law and innovative microentrepreneurial practices, the adoption of legal and economic education programmes focused on the needs of microenterprises, and rules and structures aimed at promoting microbusinesses' entry into new markets. Although these avenues cannot be explored here, this Chapter is a starting point for further research in this direction.

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